Tampere University

JUSSI SAVOLAINEN

Managing Collaborative Design Processes in Construction Projects

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Abstract

Design management plays a significant role in value creation in a construction project. Previous literature suggests that new technology such as building information models may improve the quality of design in a construction project, but to reach full potential, the effect of human behaviour on quality should be researched. Especially collaborative ways of working have been identified as a promising way to improve the quality of design. The dissertation is based on a study on how collaborative design management could enhance the quality of the design in a construction project.

The research contains multiple case studies with a mixed method approach. The data has been collected from six small-scale renovation projects (the cases) by using collection strategies of quantitative user satisfaction surveys, quantified analysis over user workshop materials and qualitative analysis over project documentation of the case projects. The analysis focuses on data in which communication concerning value-in-use information between stakeholders is observable, for example, the design instructions and meeting memos, and the satisfaction survey data, which is used to reflect the quality of the design output.

The dissertation identifies patterns in stakeholder interactions that enhance the value delivery. The identified patterns have been divided into (i) patterns of value creation impact of design tasks and (ii) patterns of quality enhancing management of interactions in collaborative design.

The dissertation contributes to the existing body of knowledge on design management in a construction project by studying the projects' processes from the perspective of value co-creation and quality engineering. The research provides novel insight to design management and elaborates on the understanding of design management as socially constructed processual phenomenon. The research demonstrates how the processual nature of a construction project can be observed by examining the dynamics of the information flows, and how the management procedures should be planned according to the users' ability to produce information.

The dissertation suggests that in the future it would be highly interesting to apply the suggested procedures in a wider range of cases, for example, large building complexes and projects, where the user needs must be anticipated due to late user engagement.

Alkusanat

Väitöskirjani käsittelee yhteistyötä rakennushankkeen suunnitteluprosesseissa, ja asiaan kuuluvasti minulla on ollut ilo ja kunnia tehdä hedelmällistä yhteistyötä monen rakentavan ja kannustavan kumppanin kanssa. Ensimmäinen henkilö, jonka kanssa keskustelin tosissani tutkimusprojektistani, oli väitöskirjan valvoja professori Kalle Kähkönen. Hän totesi hetken innokasta ideoiden esittelyäni kuunneltuaan, että kyllä tässä on sellaista ajattelua, josta saa väitöskirjan aikaiseksi. Heti perään hän kysyi, että onko minulla mahdollisuuksia ja halua sitoutua vuosien projektiin, jollainen väitöskirjan tekeminen väistämättä on. Halusta ja motivaatiosta uskalsin mennä heti takuuseen. Tämän keskustelun jälkeen olen voinut joka käänteessä luottaa saavani akateemista ohjausta, ja olen saanut myös tukea monenlaisten käytännön hankaluuksien selättämiseen. Tästä tuesta olen todella kiitollinen.

Virallisen valvojan lisäksi kiitoksensa ansaitsee myös esitarkastajat professori Emlyn Witt sekä professori Antti Peltokorpi. Thank you for the comments that helped me to finalize the dissertation.

Halua ja motivaatiota hankkeen loppuun viemiseen ei ole puuttunut, ja mahdollisuuksienkin kanssa on käynyt vähintäänkin hyvä tuuri. Ehdottomasti tärkein henkilö, joka on luonut mahdollisuuksia työn toteuttamiseen, on dosentti Olli Niemi. Satuimme samaan tilaisuuteen silloisen Tekes:n toimistolla. Kiitos Olli että annoit minulle tilaisuuden selittää ideani kävelymatkalla Tekes:n toimistolta Pasilan asemalle. Matkaa ei ollut montaa sataa metriä, mutta tästä keskustelusta seurasi vuosien yhteistyö tutkivan ja kokeilevan rakentamisen demoprojektien parissa. Nämä projektit tuottivat sekä tutkimusaineiston että pääosan toimeentulosta. Työ olisi ollut hyvin erilainen ja todennäköisesti tyssännyt jo alkumetreille ilman näitä Suomen Yliopistokiinteistöt Oy:n tutkimukseen ja kehitykseen laittamia panostuksia.

Näiden projektien aikana pääsin tutustumaan monen alan tutkijoihin, opettajiin ja opiskelijoihin useissa eri yliopistoissa. Tätä kautta löytyi myös kaksi työn kannalta ratkaisevan tärkeää kirjoitusporukkaa, joiden avulla sain laajennettua omaa maailmankuvaani poikkitieteelliseen suuntaan. Kiitokset Emma ja Anette, teidän kanssa on ollut ilo ideoida jäsentää. Olette opettaneet minulle paljon laadullisen tutkimuksen tekemisestä, ja teidän kanssa palaveeratessa opin ymmärtämään, että tutkimuksen tekeminen voi olla parhaimmillaan todella hauskaa. Ja kiitokset teille Arja ja Perttu, sillä ilman teidän kanssa käytyjä keskusteluja olisin jumiutunut huomattavasti insinöörimäisempään maailmankuvaan. Ei sillä, että insinöörien maailmankuva olisi jollakin lailla viallinen, mutta projektien

ontologisen perustan pohtiminen juuri teidän kanssa on ollut mukavalla tavalla mieltä kutkuttavaa.

Näiden lisäksi olen saanut tukea ja kannustusta usealta muuta porukalta. Alkuaikoina Rakennustalon L-siiven pienyrityksistä koostuva yhteisö tarjosi innostavaa vertaistukea. Oli hienoa työskennellä sellaisten ihmisten seassa, jotka olivat päättäneet ottaa ohjat omiin käsiinsä, asettaa tavoitteet korkealle ja uskoa itseensä. Jatko-opintoseminaarin porukka on auttanut minua kasvamaan ja kehittymään tutkijana, ja rakentamistalouden kahvihuoneen porukka pysyvine sekä vaihtuvine jäsenineen on erityisesti loppurutistuksen aikana muistuttanut leikinlaskullaan, että vakava tutkimus ei välttämättä ole ikävää tutkimusta. Näiden lisäksi Pohjois-Kalevan Lento PKL ry:n jäsenistö ansaitsee kiitokset, sillä teidän avulla olen jaksanut pitää lipun korkealla elämän erilaisten haasteiden keskellä.

Lopuksi haluan kiittää vanhempiani, sisaruksiani ja niitä läheisiä ystäviäni, jotka ovat aina silloin tällöin kysyneet, mitä väitöskirjaprojektille kuuluu. Tuntuu mukavalta, kun joku kysyy minulle tärkeistä asioista, eikä harmistu, vaikka vastaus on yleensä vähintään ylipitkä. Ja valtavat kiitokset ansaitsevat myös vaimoni Riina sekä ihanat tyttäremme Hulda ja Seela. Teidän kanssa tunnen aina olevani jossain onnistunut, vaikkeivat tutkimukset ja muut työhommat menisikään aina ihan putkeen. Teidän kanssa maailman ihmeellisyyden jännäily on parasta mitä tiedän, sillä siinä ei voi mennä pieleen, voi vain oppia ja oivaltaa.

Tampereella 6.9.2019

Jussi Savolainen

Contents

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List of Symbols and Abbreviations

BIM	Building Information Model
CE	Concurrent Engineering
DBB	Design – Bid – Build, traditional form of contracting
ID	Integrated Design
IPD	Integrated Project Delivery
LC	Lean Construction
PD	Participatory Design
PMBOK	A Guide to the Project Management Body of Knowledge
SDL	Service Dominant Logic
TMO	Temporary multi-organisation
TQM	Total Quality Management
TVD	Target Value Design
QFD	Quality Function Deployment
NPS	Net Promoter Score

List of Publications

I. Savolainen, J., Kähkönen, K., Niemi, O., Poutanen, J. and Varis, E. 2015. Stirring the construction project management with co-creation and continuous improvement. Procedia Economics and Finance, Vol. 21, pp. 64-71

II. Lundström, A., Savolainen, J. and Kostiainen, E. 2016. Case study: developing campus spaces through co-creation, Architectural Engineering and Design Management, Vol. 12 No. 6, pp. 409-426.

III. Savolainen, J., Lundström, A., & Kostiainen, E. 2016. Nuisance in communication between facility users and builder: A language barrier. WBC16 Proceedings: Volume II, 353–364.

IV. Savolainen, J., Saari, A., Männistö, A., & Kähkönen, K. 2018. Indicators of collaborative design management in construction projects. Journal of Engineering, Design and Technology, Vol. 16 Issue: 4, pp. 674-691

V. Salovaara, P., Savolainen, J., & Ropo, A. 2018. Project is as project does: emerging micro-activities and play ontology. Project Management Journal, <Revision submitted, 22.10.2018>

Author's contributions to the papers

I The author was responsible for conducting the research and wrote the manuscript as corresponding author. The data was stored and managed by Elisa Varis. The video data was analysed by Jenni Poutanen. Other co-authors provided valuable comments and suggestions to improve the paper.

II The author shared responsibility for planning the research, analysing the data and writing the paper with other co-authors. The author contributed by analysing the design process from the construction project management's perspective whereas the other co-authors analysed the design outcome from the education research's perspective.

III The author was responsible for writing the paper as corresponding author. The communication theory section was written by Emma Kostiainen, and Anette Lundström provided valuable comments. The analysis was conducted together with the co-authors.

IV The author planned the research and gathered the survey data together with Anssi Männistö. The author conducted the qualitative analysis concerning the project's process. The survey data was analysed together with Anssi Männistö. The author wrote the manuscript as corresponding author. The co-authors provided valuable comments and suggestions to improve the paper.

V The author shared responsibility for planning the research, gathering and analysing data, and writing the paper together with co-authors. The author's responsibility was to provide the perspective of project management research to the analysis whereas the other authors provided the perspective of leadership research. Perttu Salovaara acted as corresponding author

1 Introduction

1.1 Motivation and background

Too often the construction project management fails to recognise value and thus fails also in value delivery (e.g. Koskela & Howell, 2002). The dissertation is based on a study on how collaborative design management could enhance quality of design in a construction project. As explained below, collaboration is a promising way to improve both quality and productivity of construction projects.

In recent decades, relational contract forms like integrated project delivery (IPD) and alliance contracting have been introduced in various market areas (Kent and Beceric-Gerber, 2010). Relational contracting pursues to capture benefits from intense collaboration, and it can be understood as a counterforce to the trend of outsourcing and chopping deliveries into ever-smaller subcontracted entities. In relational contracting the idea is to ensure mutual co-operation by gathering the project team as early as possible and utilising the knowhow of both designers and contractors to find the best possible solution to every upcoming problem (ibid.). This shift of attitude toward collaboration is quite recent and thus provides new phenomena to research.

The starting point of relational contracting is a commercial agreement where sharing both the risks and the profits of the project is stated. This forms the legal basis of the project management, and as the basis is quite different from the traditional design-bid-build (DBB) contracting, also the management system must be developed to meet the changed commercial terms (Davis and Love, 2011). To fill this gap, managerial concepts such as lean construction (LC), integrated design (ID) and concurrent engineering (CE) have emerged. However, these are only partial solutions, and do not apply the full potential of collaboration.

Since the 1990s, ideologies such as relationship marketing (Grönroos, 1996), co-creation (Prahalad and Ramaswamy, 2004) and service-dominant logic (SDL) (Vargo and Lusch, 2004) have emerged in the business literature that have claimed to provide a game-changing edge in competition. These ideologies embrace focusing on the customer value with deepening relationship instead of mere transaction. This means that the product itself is not important. The important aspect is the series of events in customer relationships. This definition shifts the focus from market value into value-in-use, as the value is no longer seen as embedded to the product itself but the ability to utilise it (Vargo & Lusch, 2004). The value perspective is present in the lean construction ideology, like in the TFV theory (Koskela, 2000). However, the ideology itself has been production-focused. Therefore, the managerial practices of the design process must be researched to reach full competitive potential of value management. Moreover, the practices should be developed with high-level aspiration to make the customers notice the difference.

The tradition of quality engineering states that true development is such where the changes in processes result in simultaneously improved quality and productivity (Deming, 1986). There are some studies that examine the co-creation in the context of construction industry (e.g. Sivunen, 2015), but more empirical studies of process development are needed to better understand the potential implications of user-centric and collaborative ways of working. This dissertation contributes to the literature clusters of design management and quality engineering in construction projects by providing insight to the collaborative management methods with a case study approach.

1.2 Research problem

The aim of this work is to understand the role and potential of collaborative design management in construction projects. The research recognises Whittington's (1996; 2006) assumption which divides business strategy studies into two main questions with equal importance. His first main question is 'where the strategies should go', and the second is 'how to get there'. The dissertation has two research questions pertaining to the management of collaborative design process in construction projects. The first one is addressed to the purpose of a company or a project, and it sets focus on a product or a service. The second question sets focus on how to produce the product or service, i.e. sets focus on processual issues.

With the first research question, the 'where' question is reshaped into the context of this dissertation. In forming the research question, it is assumed, according to Vargo and Lusch (2004), that the purpose of any service or product is to provide skills and competences to benefit someone else and get compensation for it. The benefit in service-dominant logic (Vargo & Lusch, 2004) is viewed as value-in-use instead of value embedded into physical artefacts. Prahalad and Ramaswamy (2004) share this view as they embrace the user participation in value determination. They argue that in co-creation experiences value is co-created by the client and the company. Thus, the purpose of the design task should not be understood as merely trying to produce design documents but using one's professional expertise to benefit some other stakeholder in a chain of value-creating events.

The RQ1 studies value creation in designing tasks. In this dissertation, the concept of value is understood according to the Grönroos and Voima (2013) definition, in which value is determined as value-in-use, which is created by user when using a product. Therefore, the RQ1 studies the design tasks from the user's perspective. The design tasks, which are usually implemented by designer, are now examined in light of user perception i.e. what user expects to happen in design tasks.

RQ1: What creates value in construction project design tasks?

With the second research question, the focus shifts from the outcome of the project to the perspective of what should happen in practice within the design process. The focus is limited to the design tasks although the other perspectives, like production or tenant-owner relationship, are regarded in

case they are connected to designing. Many researchers have noted that there are several problematic issues in the design process and that various efforts have been made to improve things (e.g. Sacks et al. 2010; Kent and Beceric-Gerber, 2010; Kpamma et al., 2016). Many of these efforts seek benefits from intensifying co-operation between stakeholders, presenting promising ways of working in collaborative manner. However, research among these emerged ways has been fractioned as each application is meant to serve either one phase of a project or a rather limited number of stakeholders' points of view. This suggestion is elaborated further in chapter 2 (Theory), and one of the key issues is to gain understanding of the mechanism that enables gaining benefit from collaboration. Therefore such research is needed that would combine the understanding of the essence of collaboration in design processes and set guidelines for management.

The RQ2 takes a managerial stance by taking project team's perspective. The project team includes several stakeholders like designer of various disciplines, contractors, and of course, the project manager. As the project team is acting as the producer a product, the upcoming premises, the term, quality is used instead of value. The studied subjects are collaboration between these stakeholders, collaboration between the project team and user group, and collaboration between different user groups. The data is supposed to exist in the interactions between these stakeholders, and the quality of the interactions is affected by the management of the ways of working.

RQ2: How should the collaborative ways of working be managed to enhance quality of design in a construction project?

The positioning of the research questions is presented in Figure 1. Even though the Whittington (1996) chart has been used as a basis, neither one of the research questions purely fits to the predetermined fields. However, the chart clarifies each research question's position in relation to practical stance. The first research question sets focus on the task and choices of individual designer, and therefore it addresses the interest on a managerial level. The focus is equally addressed in how the designer or manager comes to the decision as in where the decision will lead. The second research question focuses on how single actions or events of collaboration can be connected and led as a process. The 'single actions and events' part is related to the managerial level issues but there is also a relation to the organisational level issues, as process management is meant to affect the project organisation as a whole.

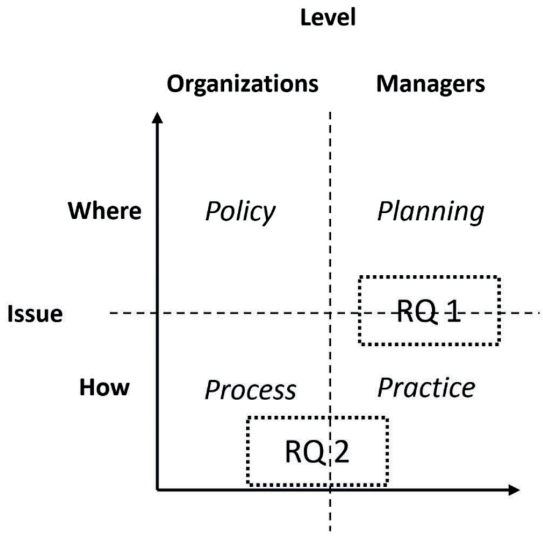

Figure 1: Positioning of the research questions (adopted from Whittington, 1996).

This positioning is aligned with Whittington's (2006) emphasis on the practical perspective on strategy and management studies, and project management researchers have also widely adopted this emphasis (Blomquist et al., 2010; Sage et al., 2012; Williams, 2005).

1.3 Research process and structure

The research process follows the logic of inductive theory building, which is a recommended approach in case studies (Eisenhardt, 1989). In inductive theory building, the purpose is to find understanding outside the current theories, and therefore the sequence of the actions is different compared to the deductive approach. The common sequence of actions in inductive reasoning is that after the research questions have been defined, a simultaneous process of both data collection and analysis begins. The literature review is initiated after getting preliminary understanding of the social context and the perceptions of the research participants by analysing the data. This is due to avoidance of a predetermined theoretical basis. (Saunders et al., 2009)

This section presents the schedule of the data collection and the analysis that are interlaced to form a process for inductive reasoning. The logic of the analysis is discussed in chapter 3.

The research process is presented in figure 2. It illustrates how the collection of empirical data is connected to each paper. First, four cases are selected (In paper I) based on theoretical sampling,

and then analysis is carried out along with additional data acquiring from another two cases. Four of the papers (papers II-V) are written as within-case analysis and the search for cross-case patterns and the shaping of the hypotheses are presented in this summary. Eisenhardt (1989) roadmap for inductive theory building suggests finalising the research by seeking supportive and conflicting perspective form a broad range of literature. Chapter 2, theoretical background, provides insight into the theories used to assess validity and generalisability of the induced conclusions.

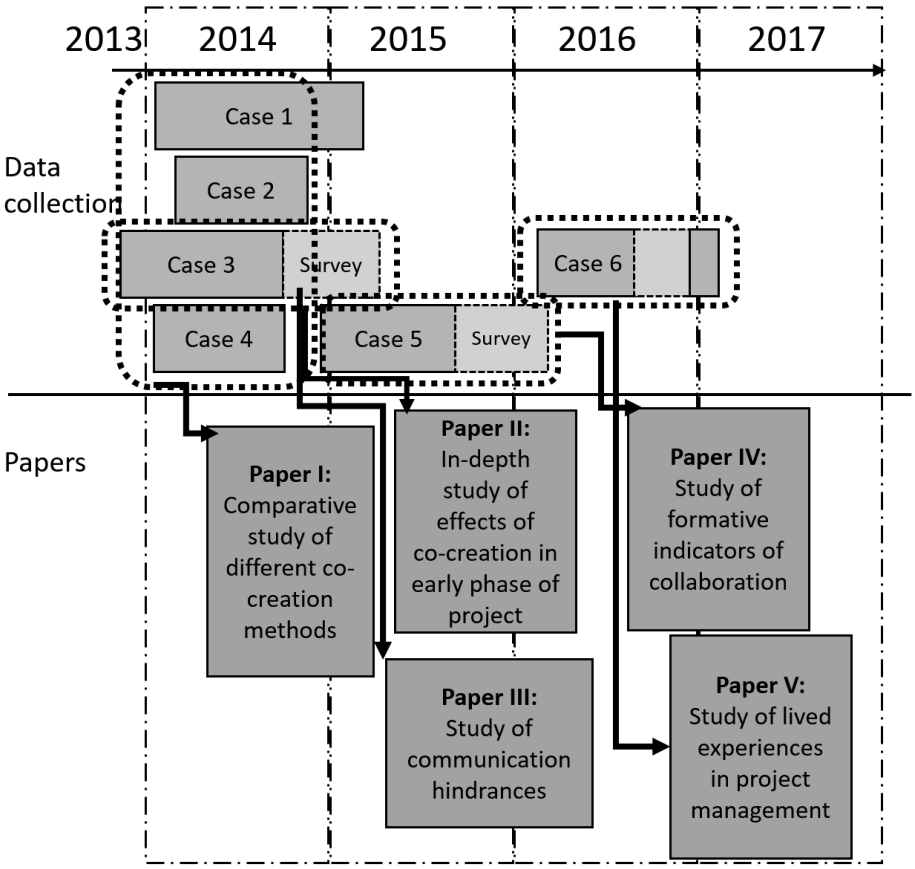

Figure 2. Research process.

The data consists of the project documentation of small renovation projects (cases). In each case, some explorative management practices were piloted. Paper I examines co-creation in four cases. The purpose of paper I was to recognise the potential of co-creation in construction projects and to get a grasp of the subject. Paper II includes an in-depth study of case 3 to gain additional understanding of how enhanced user participation shapes the project objectives and affects project management. The material produced in co-creation sessions in the beginning of the project has been

analysed and compared to the results of the user satisfaction survey. In Paper III, case 3 is studied further from the perspective of communication. Communication hindrances are studied by examining the different focuses of construction professionals and users in communicational matters.

Together, Papers II and III form an in-depth analysis of case 3, and with the comparative analysis of cases 1-4 (in Paper I) they have influenced the setup of cases 5 and 6. For case 5, best practices of participation and management procedures were picked up that were recognised in cases 1-4, and for case 6, new managerial approaches to overcome the existing hindrances have been developed. One of those new approaches was dividing the implementation of the project into two phases and having a satisfaction survey period in between (lighter grey period in Figure 2). This way there was a chance for the survey results to influence the project outcome.

Therefore, the structure of the research has been iterative. The research project has explored multiple novel approaches and assessed their pros and cons. Both Papers IV and V describe these novel approaches in a scientific manner. Paper IV describes the essence of collaboration from a managerial perspective by using data collected from case 5. It pursues to deliver understanding on how an individual manager could observe the level of co-operation or collaboration in his/her project team. Paper V describes the lived experience in construction project management. It describes how in case 6 the design decisions emerged in the dialogue between designers and users. The purpose of Paper V is to widen understanding of the meaning of the design process and demonstrate that it is more than just choices of space dimensions and materials for the construction.

1.4 Research philosophy and approach

The research philosophy of this dissertation relies on interpretivism (Saunders et al., 2009, p. 115). During the research process, systematical selections were made that have followed interpretivist philosophy in both ontology and epistemology. The combination of qualitative and quantitative methods used in the analyses is described in chapter 3.

In the first paper, the interpretivist philosophy is present in the way the continuous improvement sphere (Deming, 1986; Shewhart, 1939) is applied in the stakeholder management of project (Figure 3). An ontological choice was made to rely on subjectivism, as it was decided that the phenomenon of project management would be examined by looking at interactions between stakeholders i.e. “consequent actions of social actors” (Saunders et al., 2009).

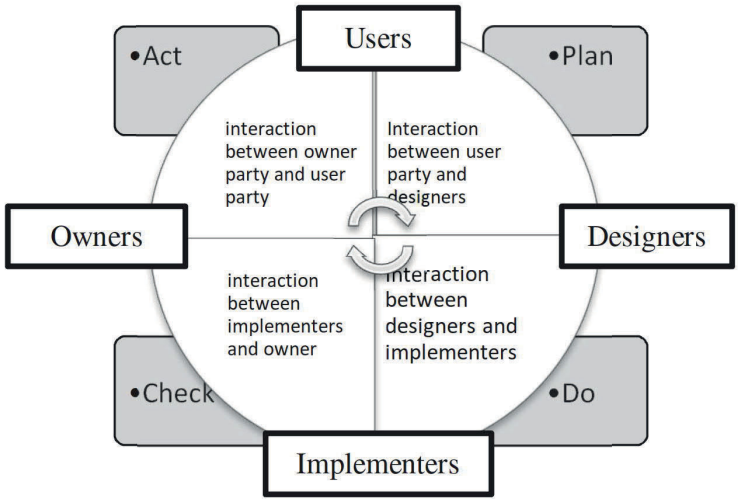

Figure 3. Continuous improvement applied to stakeholder management in project. (Paper I)

In Paper I, multiple data sources were presented. The data sources were classified by ontology and epistemology (Figure 4). After writing paper I, the author chose the data sources in the upper right corner in Figure 4 as primary data sources (meeting memos, workshop outputs, and user satisfaction surveys). The epistemological choice was made to focus on data that would tell the most about the interactions between the stakeholder roles, i.e. social actors, and would be the most interesting from the perspective of collaborative design management. This decision can also be viewed as an axiological choice, as the researcher values collaborative design management as the most interesting research subject.

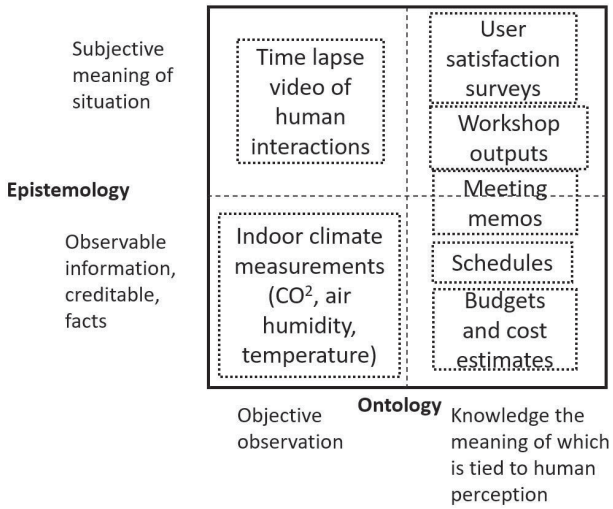

Figure 4. Data available in the project classified by ontology and epistemology.

The applied iterative research process (Eisenhardt, 1989) implies inductive approach, although the process contains phases in which the observations are compared to the patterns found in existing literature. In the beginning, there was no hypothesis to test, and the research was just stirring (as the title of Paper I says) practices of project management with a couple of new ideas. After the first four cases, some hindrances were emerging but also some positive effects, and in cases 5 and 6 it was possible to create such a project environment and data collection that provided additional information to the researched subjects. In Papers IV and V, the empirical data is compared to the predetermined patterns, and hence the approach may seem deductive if only a single paper is investigated. However, this is a part of the process that initially recognised those patterns in an inductive manner, and therefore the whole process is considered inductive.

The inductive approach has been seen suitable for studying collaborative ways of working in construction projects, where such ways of working have been in emergent stage while this research has been conducted. If the subject would have been ways of working in prominent stage, the deductive approach could have been considered as an option, but to obtain knowledge about emergent phenomena, the inductive approach was selected to produce descriptive understanding.

1.5 Outline of the cases

The cases were small renovation projects in various universities in Finland. In the study, small projects were preferred because the aim was to include projects that could be observed during the

whole timespan of the project. It was anticipated that the selected projects would last less than a year in total. The other important criteria was to have projects in which the users were present from the beginning, and in that sense the learning environment retrofits offered applicable test environment.

Case 1 was an auditorium retrofit in Oulu, Finland. The purpose of the project was to renew the layout and equipment of an old auditorium to create new high-tech learning facilities, and to better enable group working. After the project, the auditorium included group working terraces, multiple side display screens, and wireless video transfer capabilities. Collaborative design was introduced to the project team with a small-scale intervention early in the project.

Case 2 was a renovation of language learning facilities in the University of Eastern Finland. The premises included two classrooms and a few other spaces, such as the corridor in front of the classrooms. The project kicked off with three days of participatory design workshops, which were intensive co-creation sessions. The participatory design process forged a new design for the premises, and the technical designs were drawn according to that design. Apart from the participatory kick-off design workshops, the project was managed in traditional manner.

In case 3, a lunch restaurant was modified into a music learning environment in the University of Jyväskylä, Finland. The premises are located on the first floor of the music education building Musica, where there are several ordinary classrooms, and therefore it was decided to create a new kind of learning environment. To enable this, concept design was carried out as a participatory design process, lasting 5 days. After the concept design phase, collaborative design continued by interdisciplinary meetings and other sessions until the designs were ready for contract bidding. The management style was changed to traditional management after the construction phase began.

Case 4 included learning environment enhancements in two separate buildings in the University of Turku. The idea was to create places for informal learning and group works. The co-creative design was needed because in both buildings, Educarium and School of Economics, the renovation was related to ongoing paradigm change. Educarium is home to the Faculty of Education, and they wanted to create an environment for phenomenon-based learning and learner-centric approach. In the School of Economics, the library wanted to offer students a new kind of accessible learning space, and the faculty wanted to somehow make their activities more visible. There was no design guide for these kind of renovations, and the users wanted to share their expertise, so the co-creative design process was a natural approach for concept designing. Collaborative ways of working were utilised throughout the project by setting focus on well-functioning communication and facilitating interactions between different stakeholders.

Purpose of the project in case 5 was to renew the learning environment of journalism studies, the rehearsal newsroom, to match the needs of new media environment. Since the previous renovation

of the premises in 2005, the focus in the journalistic media has moved from print and desktop-oriented production and consumption to ’mobile-first‘ and a more audio-visual approach. The new media learning environment was supposed to include the latest technology, and the aim was to create a unique place for journalism education. Therefore, it was seen that the project would clearly benefit from collaborative design. Case 5 was launched a year after the launch of the first 4 projects, and therefore it was possible to utilise the ‘lessons learned’ in the project planning.

Case 6 was established to elaborate the collaborative project management practiced in case 5. Case 5 had been successful in terms of customer satisfaction and schedule, but the cost performance could have been better. It was realised that the project must be managed in terms of the customer experiences. In this project, the old-fashioned office premises were renewed to support a more communal working atmosphere, and to achieve this, the co-creation of a totally new office concept was necessary. User collaboration was taken further than in the earlier projects: not only the co-creation events were designed to work as user-friendly interactions but the whole process was planned and scheduled to serve the creation of a new working atmosphere as well as the physical premises.

2 Theoretical background

This dissertation contributes to the literature clusters of design management and quality engineering in construction projects. Even though the term design management is widely recognised, there is no single, widely accepted definition for it. Rather, there are various definitions, which have different stances, and may partly conflict with each other. One of those stances is focusing on schedule (Choo et al, 2004; Koskela et al., 2002). This perspective considers management as quite mechanical duty to optimise time and resources consumed in the process. On the other hand, some studies embrace the collaborative aspect of design management (Emmitt and Ruikar, 2013; Elf et al., 2015; Kvan, 2000), therefore taking the humane perspective. Yet studies exist that aspire to combine these two into a holistic approach (e.g. Chua et al., 2003; Arroyo et al., 2016). These studies pursue to identify or develop managerial implications for professionals. In this category, target value design (TVD) is one of the most ambitious efforts to develop novel practices for design management. The main idea of TVD is to make client's value a driver of design in a cost-conscious manner. In TVD, the design information and designers are actively managed to reach the cost target with maximum value (Zimina et al., 2012).

The perspective in this dissertation is quite similar to the TVD approach, although there are some differences. First, TVD is considerably cost focused. It pursues cost rationalisation instead of cost minimisation (Zimina et al., 2012), but as the TVD process begins with determining an allowable cost based on client's business case (Alves et al., 2017; Zimina et al., 2012), the focus is cost oriented. In contrast, this dissertation focuses on how client may benefit from construction project, i.e. emergence of value and quality. The conception of value is another notable difference between TVD approach and the perspective of this dissertation. In TVD, value is understood as an entity that can be determined in the beginning of a project. On the contrary, in this dissertation value is understood as an emerging concept the essence of which is induced during the project.

The difference between these two value conceptions lies in their ontological basis. The first one assumes that value may exist independently of the social actors. The latter one assumes that value is created from the perceptions and consequent actions of social actors. Changing the ontological positioning requires new perspectives to the examined phenomenon. Therefore, the theoretical background is sought from quality engineering, marketing research, and processual studies instead of reviewing merely design management literature. This choice also follows the logic of inductive research approach.

The structure of the theory chapter is designed to lead from the essence of quality to the delivery of quality via collaboration. The literature review begins from the quality engineering perspective, which is a discipline that studies how to deliver goods and services that meet the customer needs. After that the research on customer needs is reviewed. Understanding the logic concerning customer needs is essential, if one aspires to understand how to set up quality-related targets for projects.

Moreover, to understand how to reach the targets, the process of a construction project is reviewed. The final section of the theory chapter discusses collaborative ways of working and the effect of collaboration to the process and its outcomes.

2.1 Quality engineering

In defining quality engineering, this dissertation relies on the American-Japanese quality engineering tradition and its milestone publications (Deming, 1986; Taguchi 1986; Akao 1990; Juran & Godfrey, 1998) which have been widely adopted, and have been utilised in various quality movements like Quality Function Deployment (QFD) (Akao, 1990), Six Sigma (Steward & Spencer, 2006) and Total Quality Management (Samson & Terziovski,1999).

If the quality engineering tradition is examined from the construction management's perspective, probably the most influential movement is lean construction, a sector-specific adaption of the lean production philosophy. Lean production philosophy is inherited from the school of quality engineering that combines American tradition of statistical quality control to Japanese tradition of commitment to continuous improvement (Juran & Godfrey 1998). The idea is to improve price-quality ratio by first recognising value-providing aspects and then minimising effort and material from such aspects that do not provide value for customer, thereby eliminating waste (Forbes & Ahmed, 2011).

When pursuing to improve quality, the most important thing is to understand the purpose of the business. Deming (1986) argues that for a company wishing to stay in business there are two kinds of problems: problems of today and problems of tomorrow. One of the key issues in the problems of tomorrow is how to provide new products and services that will help people to live better (Deming, 1986). Juran and Godfrey (1998) determine quality with dual meaning: *On the one hand, quality is those features of the product that meet the customer needs, and on the other hand it is freedom from deficiencies*. Thus, improving quality means either increasing features that are relevant to customer or reducing deficiencies. Increasing features will probably increase cost but reducing deficiencies will probably reduce rework and customer complaints, and therefore reduce costs. Because improving quality may increase cost, Deming (1986) sets focus on the whole production environment and encourages concentrating efforts on development that increase productivity and quality simultaneously. The production environment includes both the machinery of the manufacturing plant as well as its management. In addition, Deming (1986) emphasises the pride of workmanship in cutting down waste.

Juran and Godfrey (1998) share this vision of holistic impact of quality thinking. They illustrate the vision by using the term "big Q" in contrast to "little q". The big Q means thinking quality as a problem of how a company can provide a combination of product and service, whereas the little q understands quality delivery as a production problem of meeting the predetermined specifications. Meeting the

specifications, for example staying within the tolerance limits, may seem rational, but one must be able to set suitable tolerances. In Taguchi methods (Taguchi, 1986) the tolerances are set by defining the rework cost to company and total cost of defect to the customer. To do that, one must, beside understanding customer needs, know how the customer uses the product. Therefore it is essential to listen to the voice of the customer when planning the production (Mazur, 2003; Akao, 1990).

Even though some corners of quality engineering may seem rather mechanistic, the philosophy behind it is rather philanthropist, as it emphasises employee empowerment, motivation, leadership, pride of workmanship, driving out the fear, and dedication to education and training (Deming 1986; Juran & Godfrey 1998). In contrast to mechanistic orientation, like the one in TQM or Six Sigma, the lean construction embraces the managerial attitude toward open discussion and coaching (Forbes & Ahmed, 2011). Therefore it is logical to have lean philosophy as a basis for research of collaborative ways of working.

2.2 Customer needs and value

The customer needs and freedom of deficiencies are determined as two focal elements of quality in the Juran and Godfrey (1998) definition. In this paragraph, the customer needs are discussed as key to create customer value. To separate concepts of value, quality, and customer needs, we rely on Grönroos and Voima (2013) definition of value, which defines “value as value-in-use, created by the user (individually and socially), during usage of resources and processes (and their outcomes)”. Therefore, difference between value and quality is that value refers to user experience and quality refers to product features, although both concepts exist in interaction with user needs, and both can suffer loss because of erroneous delivery.

When discussing customer needs, it should be emphasised that they are not same as product qualities, although in common discussion there is danger that these two are mixed up. Usually a single customer need is related to multiple qualities of a product and vice versa. Akao (1990) gives an example concerning pre-fabricated housing: proper room temperature, bright indoor environment and comfortable dining represent customer-demanded quality and are closely related to customer needs, whereas insulation, ventilation, and indoor lighting are qualities of the product.

Human needs are often thought as hierarchy, “where the appearance of one need usually rests on the prior satisfaction of another, more pre-potent need” (Maslow, 1943). These hierarchies are useful for conceptual designing of product or service, because in the beginning of the project one must somehow clarify the relative importance of quality demands made by customers (Akao 1990). Even though quality engineering discusses relative importance, the relativity is not seen as linear, but rather as clustered into such categories that Maslow (1943) describes.

To illustrate how this affects the selection of product or service features, Kano (1984) has introduced a categorisation which divides product features into three categories based on their effect on customer satisfaction: the must-be feature, one-dimensional features, and attractive features (Figure 5). The nature of the must-be features is that when corresponding qualities of the product are increased, the satisfaction for the product is first increased rapidly, but soon after the effect on satisfaction is saturated. For example, in ventilation design, people need a certain amount of litres per second delivered to keep the indoor climate fresh. However, delivering extra air does not increase the customer satisfaction after a certain capacity is reached. In one-dimensional features, the satisfaction always increases by the same amount regardless of the level of functionality. For example, when lowering upkeep costs, such as in energy consumption, the saved money increases customer satisfaction regardless of the level of the costs. In attractive features, adding qualities has only limited impact on satisfaction, but adding enough of them will result in exponential growth in customer satisfaction. This kind of behaviour is usually linked to luxury products. Having only some luxuries does not mean that the product is a luxury product. Luxury should be sensed in every aspect of a luxury product.

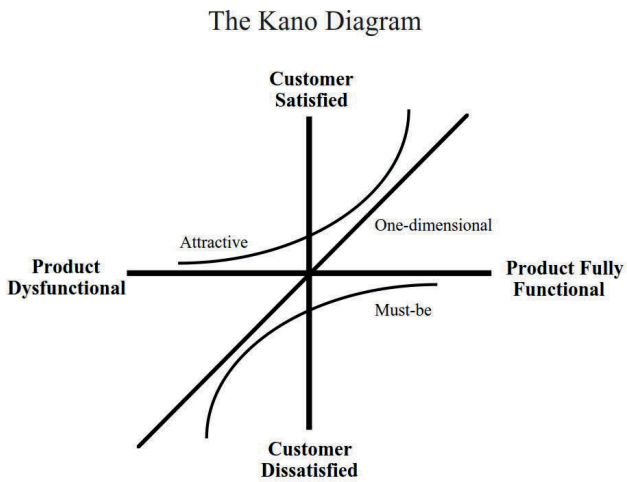

Figure 5. Kano diagram (Berger et al., 1993).

There are some quite widely accepted principles of need hierarchies, like the Maslow's (1943) perception that the physiological needs (e.g. air, water, food) must be sufficiently satisfied before higher needs become relevant, or even exist. However, when thinking about customer need relevant to product or service development, they are suggested to be rather context-dependent. Consequently, context-dependent categorisations exist and they are adapted to the built environment. For example, den Heijer (2013) divides needs into five categories: healthy, safe, social, attractive, and inspiring.

For examining the relationship between spatial and organisational issues, Lindahl (2004) uses four aspects: health and safety, configuration between space and actions, symbolic qualities, and degree

of participation. The first three may be understood to describe either customer needs or product qualities but the fourth one is obviously a communicational issue. Lindahl (2004) noted that renovation projects are often just a part of a continuous process of organisational development, and therefore the communicational issues in participatory design should be developed.

The communicational issues concerning customer needs are a vital part of project management skills, as communication has an important role when users evaluate and construct their experience of built environment, spaces and places (e.g. Airo 2014). In general, organisations process information for two reasons: to reduce uncertainty and equivocality (Daft & Lengel, 1986). Uncertainty means that there are things we do not know, and to reduce this we need to gain new information. Equivocality means that there are things, which may have multiple meanings or a meaning which is unclear to us. To reduce this, people in the organisation must talk things over and agree on definitions rather than acquire new information (Daft & Lengel, 1986). When examining this definition in the context of customer needs and quality planning, it may be understood that the process of reducing both uncertainty and equivocality is a relationship between company and its customer that must be carefully managed.

The importance of each human interaction in business is emphasised in the school of relationship marketing, as it claims that marketing is more than just giving information about the product itself, its price and availability (Grönroos,1996). Relationship marketing suggests that most employees are part-time marketers whose duty it is to exchange knowledge with customers on how the product or service fulfils their needs. The emphasis of human relationship is taken even further in service-dominant logic (SDL) (Vargo & Lusch, 2004) which re-defines the fundamental unit of exchange as ‘the application of specialised skills and knowledge’. In this view, the tangible goods are merely vehicles of transferring skills and knowledge. The exchange can only exist between two individuals or groups of people, where one benefits from the skills of the other. A provider and a user must have a relationship that ensures that the user knows how to use the provided commodity, and therefore the value cannot exist permanently in the product (Vargo & Lusch, 2004).

The customer relationship in the design phase of a construction project contains several peculiarities. First, service provider is not a static entity; instead, it is a temporary multi-organisation (TMO), consisting of designers and other professionals with varying backgrounds coming from various companies. In addition, customer is not a single entity with an unanimous voice; instead, it is a complex system of interest groups. (Cherns and Bryant, 1984) Therefore, managing communication between customers and designers requires specialised skills. Customers try to express their needs but the expressions contain varying amounts of uncertainty and equivocality (Daft & Lengel, 1986). Customers are not professionals in delivering the information that designers require. On the other hand, designers may be seen as part-time marketers, as interacting with customers is only a small part of their duties. They spend most of their work time on designing systems according to requirements and regulations, and coordinating with other design disciplines. There are of course designers who

have understood that the communication is an important professional skill but such expertise should not be taken for granted.

One source of the equivocality in the relationship between designers and customers comes from the difference between quality and value. Both may discuss customer needs but the context of the customer is value-in-use (Grönroos and Voima, 2013), while the context of the designer is quality of the product, i.e. how the product meets customer needs (Juran and Godfrey, 1998). Even though they discuss the same topic, customers focus on satisfaction in use situations, while designers focus on understanding which qualities the product should include. Yet, as they discuss a non-existing product, their expressions include uncertainties; they have to anticipate both the use situations and the qualities' effects on the needs. The difference between designer and customer contexts is illustrated in Figure 6.

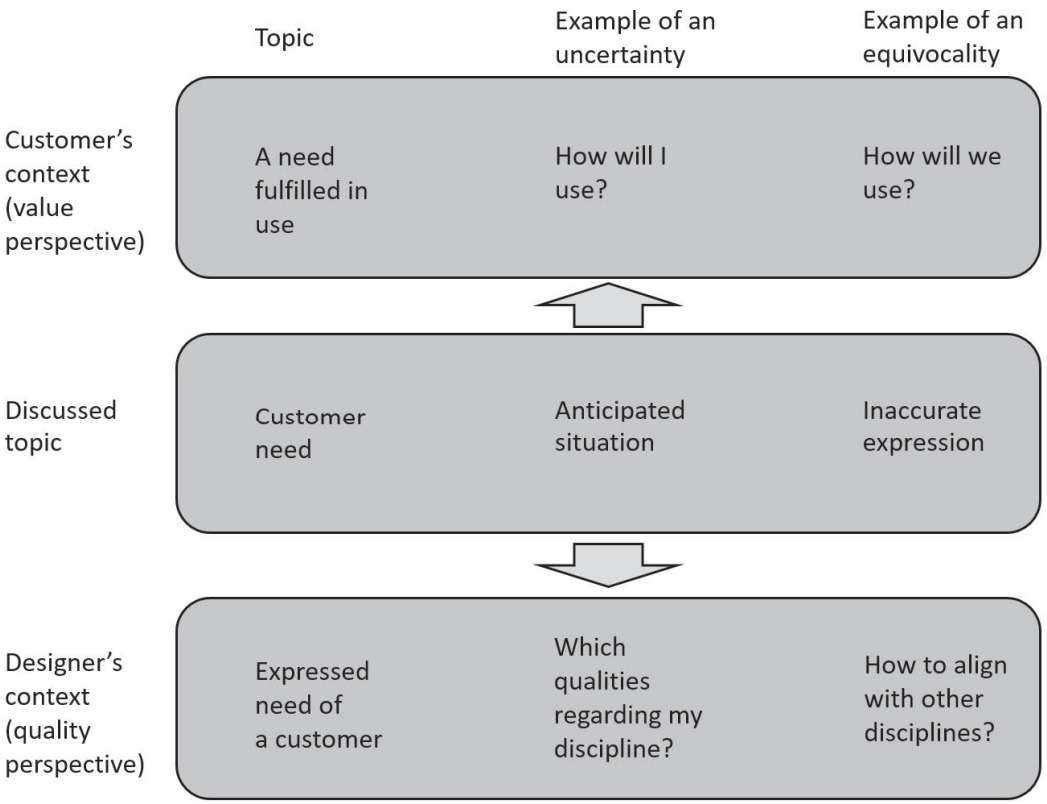

Figure 6. The difference between designer and customer contexts in discussion related to customer needs.

From engineering value to co-creating value

The competitive advantage of a company can be understood as its capability to co-create value, i.e. form a chain of interactive experiences which both give information to the provider on the user's needs and benefit the user whose needs are served. In this view, the focus is on user needs and communication instead of push marketing of a product that the company has designed. (Prahalad & Ramaswamy, 2004)

Since the year 2000, hundreds of articles have been published concerning co-creation (Galvagno & Dalli, 2014), resulting in increased understanding concerning both value per se and emergence of value in interactions between customers and producers. It replaces the value creation mechanism, the engineering perspective, with a new kind of process, in which both the customer and the producer are empowered by a feeling of mutual trust and a common goal.

In quality engineering approaches, as discussed in chapter 2.1, the value is understood as a concept that can be captured by understanding which features in the product are important for the customer, and then writing a specification, which describes the customer demands. The value co-creation adds the human inspiration into the equation as a factor that, on the one hand, may lead to unexpected demands by the customer. On the other hand, it may provide innovative solutions to both original and emerging customer requirements.

In their review of articles related to co-creation, Galvagno and Dalli (2014) identified three main perspectives in the articles published between 2000 and 2012. The first is the service science perspective, in which customer creates value by means that a company provides. The second is the innovation and technology management perspective which underlines the co-creative relationship's ability to enhance innovations. The third is the marketing and consumer research perspective which embraces an active relationship that enables better understanding of the customer needs and the empowering effect of active engagement. Even though co-creation is viewed as a multifaceted and nuanced concept (Saarijärvi et al., 2013), the mainstream of the research is well in line with the seminal work of Prahalad and Ramaswamy (2004), in which co-creation is understood as a tool which provides competitive advantage.

In addition to the mainstream literature, co-creation is viewed also in the light of rising consciousness concerning societal and environmental challenges. In co-creation, as the quality of the relationship is emphasised, the customer is no longer seen as a passive informant from whom the 'need information' can be extracted by conducting a survey. Instead, the company must establish a trustful relationship with the customer that allows them to discuss customer information on a relatively deep level, the level of an individual's appreciations and values. (Gustafsson et al., 2012)

To establish and maintain a trustful relationship, the company must share the same ideologies, and the same societal and environmental values with its customers, at least to some extent. Ahen and

Zettinig (2015) suggest that having a strategic corporate responsibility policy would provide competitive advantage via legitimacy in the eyes of the society. The logic is that the customers and other stakeholders are more willing to engage in co-creating experiences with companies that share their worldview and serve the common good instead of only pleasing their direct customers. The legitimacy is considered as a key to society's resources, both tangible and intangible, which can be innovatively organised to create superior value propositions.

Scharmer and Kaufer (2013) link this behavior to "an emerging field of connection and consciousness, a collective concern about the well-being of all living beings, including our planet." They consider co-creation as multi-lateral communication which, in addition to creating new value propositions, shifts a mindset from one that values one's own well-being to one that values the well-being of the whole. The logic is that people get satisfaction from such activities as taking care of others, and this is reflected to needs that cannot be satisfied by merely consuming products and services. And as buildings are in many cases designed to serve more than a few people, the Scharmer and Kaufer (2013) perspective to co-creation offers an interesting framework for this research.

2.3 Project process

Every activity in business is a part of a process. A simple way of describing process is to do a flow chart presenting how the production is divided into several stages that have their specific tasks of transforming its inputs to outputs. Every stage is understood as a client of the previous stage, and the final stage is ought to deliver the product or service to the ultimate customer. (Deming 1986)

The production process is easy to figure in a manufacturing plant, where the raw materials are put on the assembly line, and the product, a car for example, is assembled part by part, first assembling the chassis and then installing doors etc. However, describing a project process is quite different from that. A project is defined as a temporary endeavour that creates a unique product, service, or other result (Project Management Institute, 2013). This is fundamentally different from a process with a repeating nature. For repeating production, Juran and Godfrey (1998) determine three processes of managing quality: quality planning, quality control (of the production), and quality improvement. In projects, there are also planning and control processes. For example, A Guide to the Project Management Body of Knowledge (PMBOK) defines that project management processes are initiating, planning, executing, monitoring and controlling, and closing (Project Management Institute, 2013). However, it seems that the process improvement does not fit in. Although PMBOK recommends applying continuous improvement as a method to improve quality, there is very little information given on how to apply it in a unique context-dependent environment typical for projects. The idea of continuous improvement, as presented in the plan-do-check-act cycle (Deming, 1986; Shewhart 1939), cannot be benchmarked as such to a project, which, by definition, does not have repetitive nature.

Even though a project's unique nature brings hindrances into benchmarking quality improvement, the phasing used in quality engineering process is quite similar to the one in the project management process. In quality function deployment (QFD) (Akao, 1990), the product development stages are: quality planning and quality designing, detailed designing and preproduction, and process deployment. The Taguchi (1986) method describes quite similar phasing using the terms system design, parameter design, and tolerance design. In both techniques, focus is firstly on the question of what customer need should the outcome meet, and then on how the outcome should work or behave, and finally on what is the suitable manufacturing process for the best possible outcome. The quality management task in production or execution phase is understood as controlling, i.e. monitoring the variables and staying within the tolerance limits (Taguchi,1986).

However, this kind of vision of processes has been criticised for being mechanistic, and for, especially in project processes, not considering the temporal aspect and situation-dependency (Langley, 2007; Stingl & Geraldi, 2017). If project process is viewed as a flowchart that presents how each stage leads toward the desired outcome, the process is viewed as an invariable plan. In contrast, the project-as-practice school (Blomquist et al., 2010) claims that project management studies should focus on what is actually done within a project instead of studying project plans. To understand the actual process of a project, the focus should be set on small situated events, the microactivities instead of only portraying the big picture (ibid). For example, a conversation between stakeholders is a microactivity that may affect the outcome of the project even though the project plan would not recognise the role of informal conversations.

The situatedness of the microactivities means that there might be unexpected variables in the situation where the microactivity occurs. For example, there may exist elements of uncertainty on the future and anxiousness caused by it (Rolfe et al., 2017). When thinking about the processual nature of the project, the outcome is not yet achieved, when the process is ongoing. The outcome is 'becoming' instead of 'being' (Chia, 2013; van der Hoorn & Whitty, 2015) and often there are many people that may still influence the outcome. Different stakeholders may have different objectives that may cause bargaining, and yet there may be emotional issues that may affect project outcome even without a rational reason (Stingl & Geraldi, 2017).

To better deal with human influence during a project, software industry has developed an agile project management model that is determined by four principles: individuals and interactions are emphasised over processes and tools, working software is emphasised over comprehensive documentation, customer collaboration is emphasised over contract negotiation, and responding to change is emphasised over following a plan (Schwaber, 2004). However, doubts have occurred whether this concept fits demanding construction projects (Furman, 2014), albeit there are also advocates for the agile model in the construction industry (Owen & Koskela, 2006).

In general, there is an interest for process development and enhanced customer focus in the construction industry. For example, the TFV (transformation-flow-value) theory (Koskela, 2000) examines how construction production could be developed to better and more fluently serve customers, while lean construction examines how construction production could be developed by cutting waste (Forbes & Ahmed, 2011). However, these are production-focused examinations, and the processual studies should be extended to cover also the design tasks.

2.4 Collaborative design

Kvan (2000) describes collaboration in design as working together in a higher sense to achieve a holistic creative result. Emmit and Ruikar (2013) describe the collaboration in temporary project organisations as an activity of multi-disciplinary groups and teams that are bound together by legal contracts and the participants' desire to achieve a shared objective. Both determinations indicate that there is something more than mere contract that brings the team members together.

Collaborative atmosphere and sense of togetherness relies on mutual trust between the collaborators. The collaborators have to trust each other's competence, but they should also be able to trust that the other party will act expectedly (Chiocchio et al., 2011; Ning, 2017). Collaboration eases conflict management and task coordination and improves communication and feedback processes (Chiocchio et al., 2011). On the other hand, without a collaborative atmosphere, a habit of 'not speaking' or 'not listening' may develop if people fear that expressing new ideas is not supported or appreciated (Forbes and Ahmed, 2011). In collaborative communication it is necessary to understand correct usage of both socio-emotional roles that focus on personal relationships and task roles that are related to solutions and achieving the common goals (Emmitt and Ruikar, 2013).

Is this dissertation, the term collaborative design is used as an upper-level term that includes various sub-concepts such as participatory design (PD), integrated design (ID) and concurrent engineering (CE). These three terms are used to describe how collaboration could bring advantages to design practices, but the terminology has not been fully agreed on. Some researchers use the term 'collaborative design' as a synonym for participatory design where the role of different stakeholders, especially users, is embraced (Elf et al., 2015). In some papers, it is used to describe working with shared design tools such as the Building Information Model (BIM) (Plume & Mitchell, 2007; Oh et al., 2015). These terminological issues underline the need for more holistic understanding concerning the potential of collaboration in construction project management.

PD is dedicated to enhancing the user's ability to maximise value-in-use (Kpamma et al., 2016). Even though PD has some similarities with relationship marketing, co-creation and SDL, its perspective is decisively narrower. PD can be understood as a way of doing architectural design within the

traditional process of construction project, whereas the ideologies focused more on customer relationship lead toward a much more radical change in the business processes. However, the clear positive impact of co-creation in building design is not self-evident. Lindahl (2004) annotates that albeit the user participation has been used at least since the 1970s to create more user-friendly workspaces, it is not clear how the user-friendliness affects organisational performance. It is important to consider whether user-centric architectural design is just comfortable or also beneficial in the economic sense.

ID is dedicated to enhancing designers' ability to coordinate design work and produce as accurate information as possible. Appearance of ICT tools like BIM has required new working procedures but it seems that on some occasions (Sebastian, 2010; Rekola, Kojima & Mäkeläinen, 2010) the term ID is used primarily because of BIM and only secondarily because of integration. However, in this dissertation the role of ID is understood as collaboration that aims at improving design quality by utilising collaborative ways of working and suitable technical tools. Clash detection by using BIM is an example of such collaboration.

The role of CE is to find a cost-efficient design solution through collaboration between designers and builders. Love and Gunasekaran (1997) suggest that the mechanism that improves performance in the CE is eliminating non-value adding activities with the help of a multidisciplinary team. Kamara, Anumba & Evbuomwan (2001) describe CE as practices of cohesive design processes where the co-operation between designers and manufacturers is enhanced, and it pursues higher customer satisfaction by reducing costs and improving quality.

3 Methodology

3.1 Research design

The research is conducted to shed light on the emergent phenomena of collaborative ways of working in design management. As described in section 2.4 Collaborative design, practices of collaborative ways of working exist but there is no model that describes how collaboration should be managed in a project as a whole. Thus, the cases covered in this research represent exploration into finding new insight to the management and value creation of collaborative design. The phases of the exploration are presented in Figure 7. In the first phase, collaborative ways of working have been sought by testing co-creation in four cases. In the second phase, the identified best practices of collaboration are brought into one project, case 5, and the collaborative ways of working have been extended to cover the whole project from feasibility studies to the using and testing phase. In the third phase, case 6, the project plan and its phasing are renewed to serve better the lived experiences of the users. As the basis of project planning is renewed in phase 3, the exploration has entered a new, unmapped zone, and therefore the research project cannot give an accurate picture of the collaborative ways of working in design management but it will reveal their possibilities in improving the quality performance.

Figure 7. The phases of the research.

The research strategy was case study, which uses ethnography, archival study, and survey as data collection techniques. The data consists of 6 cases, and therefore this is a multiple-case study. Table 1 presents which data collection techniques are used in each case. In the analysis, qualitative procedures have been used to analyse project documentation, and quantitative procedures to analyse survey data, which means that this is mixed-method study. The reasons for this choice are explained in the discussion chapter below.

Table 1. Data collection techniques in each case.

Paper	Case(s)	Data collection technique(s)	Data analysis procedure
Paper I	Cases 1-4	Ethnographies	Qualitative observations
Paper II	Case 3	Archival study, Survey	Qualitative inductive content analysis
Paper III	Case 3	Archival study, Survey	Quantified inductive content analysis, quantitative survey analysis, qualitative pattern identification
Paper IV	Case 5	Archival study, Survey	Qualitative content analysis, quantitative survey analysis
Paper V	Case 6	Ethnographies	Qualitative narrative analysis

3.2 Data and analysis procedures

In paper I, multiple data sources are listed that would have been available for the research. In the early stage of the research project, it was thought that the project could have an experimental nature in finding evidence supporting supremacy of certain design solutions. In paper I this approach is described as evidence-based design. However, the preliminary findings reported in paper I indicated that the success was not related to the chosen design solution per se but the collaboration that created the solutions. These preliminary findings were based on the ethnographical observations of the designing process, and for that reason the data collection technique in paper I is regarded as ethnography (Table 1). The multiple sources of data included project memos and a vast amount of creative workshop materials, enabling the use of the ethnographical data collection technique for qualitative analysis.

In papers II and III, the data of case 3 is studied with different analysis procedures. The data consists of workshop materials, meeting memos, and satisfaction surveys (n=54) with open and closed questions. The data collection technique concerning meeting memos and workshop materials was archival study, as the data was originally produced for project management purposes. In paper II, the objective was to form user need categories, and study how the collaborative design methods affect fulfilling the needs in different categories. To reach this goal, an inductive content analysis was conducted to workshop materials, meeting memos and open answers of satisfaction survey.

In paper III, the satisfaction survey of case 3 was used in quantified form, and project documentation was used to identify decision-making patterns in qualitative manner. Quantified codes were used to recognise the relational importance of user need categories. The answers to the closed questions of the satisfaction survey were analysed by observing the ratio of highest rank answers to all answers, a method inspired by Reichheld (2006) Net Promoter Score (NPS). The analysis was conducted within the context of communicational hindrances between the construction professionals and the users of the building.

In paper IV, the project documentation and satisfaction survey of case 5 is analysed using a mixed method. The data consists of workshop materials, meeting memos, schedules and cost calculations of the project under examination, and a satisfaction survey that was conducted 5 months after the project handover. The workshop materials and meeting memos were analysed by using indicators recognised deductively in literature review. The satisfaction survey was analysed by using a similar NPS-based distribution analysis as in paper III.

In paper V, the data consists of interviews with the end users of the space, video-taped workshops, memos of theme group meetings, notes of the premises' commissioning meeting (the end users enter the new space), layout documents, photographs, and a survey. Data collection and analysis applied organisational ethnography methods and a hermeneutic approach to materiality. From the various materials, two types of process narratives from a practice perspective were constructed. The first round of the analysis describes the chronology of the project. It represents the practices of the project in three vignettes, relying on the key phases of the project. The second round of the analysis looks inside these chronological vignettes by taking a closer look at what occurs inside the project practices.

4 Summaries of the papers

4.1 Paper I

The first paper investigated challenges and benefits that increasing collaboration would bring into construction project management. The paper mainly focused on re-arranging stakeholder interactions and enhancing information exchange between different roles in a project organisation.

In the paper, four cases were analysed to understand the effect of co-creation and communication routines on project outcome. The cases were small space modification projects located in various universities in Finland. The original idea was to research co-creation and continuous improvement as methods for evidence-based design via the following three aspects:

1. What is the actual improvement in the utilisation of the premises when a retrofit project has been carried out? It is quite common that retrofit projects are carried out with determined objectives of improvement. Very rarely is the actualisation of the improvement and the real current use of the premises later confirmed against the target designs, such as: “Do people use the premises in the ways that the architect imagined in the design phase?”, “Has the utilisation rate improved?” and “Has the mood among the employees/users changed somehow?”)
2. How should new practices be implemented? Based on prior experience within the organisation, it was assumed that every new practice causes resistance among both users and designers that disturbs design work. Co-creation practices (Prahalad & Ramaswamy, 2004) were identified as a promising way to confront these problems.
3. What tools could be used for marketing new ideas? The idea was to provide information about new solutions from users to users. In this way, information would be in a format that a user group could understand when planning a facility upgrading projects. This would also facilitate communication between architects, project management team, and users.

However, evidence-based design practice focuses on delivering such a design that has already been tested somewhere else, as the idea is to select solutions with evidenced benefits. Co-creation, on the other hand, is a method which is supposed to create novel and unique solutions in a context-dependent manner, and therefore the focus of the analysis was shifted from the outcome of the project into the managerial practices.

There were two kinds of interventions in the cases: the co-creational workshops and facilitated communication, and these were applied in the cases to varying extents. In case 1 the only intervention was that the researcher briefed the project manager on how to facilitate a single co-creational workshop. In cases 2 and 3 the feasibility studies and concept development were conducted in a series of participatory design workshops with a total duration of three days in case 2 and five days in case 3. The researcher participated in all of these co-creation process sessions. In case 3 there was also an intervention in the design management communication routines, as the researcher was hired into the project to coordinate information flows and decision-making of the design management. In case

4 the researcher was the project manager which facilitated four half-day participatory design workshops for each modification area (four workshops in total), and the whole project was managed with enhanced communication routines.

As the researcher had an active role in most of the cases, the method was considered action research, which provided ethnographical observations related to beneficial collaborative management procedures. Data on the project outcome was also collected by metering the quality of the indoor climate, recording time-lapse videos, and having a brief satisfaction survey, in which the users participated with their smart phones. This data was planned to be used in evaluating the project outcome. However, full results from the data collection on the project outcome were not available while writing the paper, so the reported findings are mainly based on the ethnographic observations of the workshops and communication interventions.

In the analysis, four major findings were found concerning the development of the managerial practices. The identified aspect was used as best practice in the upcoming cases.

1. *Prioritisation.* The co-creation phase has improved the mutual trust among the parties of the project. The cost estimates in the end of co-creation phases helped in starting the prioritisation dialogue between the users and the owners. The prioritisation enabled the designers and the implementers to come up with suggestions for cost savings. Without the prioritisation, the cost saving suggestions would have been probably more or less blind vis-à-vis the users' ability to utilise premises. Thus, continuous improvement was enabled.
2. *Developing understanding*. Knowledge on how the users may and will use the premises increased significantly during the project. In principle, improving the premises is usually only a part of the user's larger organisational development project. When the focus is set on this scale, it becomes much easier to understand how users view a situation, i.e. premises improvement projects should constantly create such data, which the user organisation can utilise in their organisational improvement projects. In addition, it is not realistic to think that all information for a design process would be available at once in the beginning of a project.
3. *Consensus.* In the beginning of a project, users usually do not have ready-to-use consensus on their wishes and needs in a form that would enable using their vision as initial information in the design work. Consensus may be reached by a well-facilitated co-creation workshop. Moreover, the meaning of the workshop is to guarantee equal voice for each stakeholder so that true mutual understanding is achieved. In comparison, if a workshop is not deliberately pursued, the strongest voice takes over and obviously a bias situation will then prevail between the stakeholders.
4. *Tolerance for rambling dialogue.* All the communication between users may appear as irrelevant disinformation from the perspective of building and design organisations. Discussions take time and sometimes have only a small effect on final designs. Furthermore, discussions may complicate the project manager's work, as the power over design decisions is shifted from a design organisation to a user organisation. For some managers, it may be difficult to see the pros of new practices when the cons are so imminent and, thus, they may resist such changes. To overcome such barriers, the benefits of enhancing customer experience should be put forth at operational levels.

The original idea of the research was to study co-creation as a method for evidence-based design. However, as the findings of the study reveal, co-creational workshops and enhanced communication routines improve quality by creating a collaborative atmosphere. The solutions can be selected only after the concept of utilisation is decided on, and that requires consensus on prioritised needs that are supposed to be fulfilled. The findings do not oppose the idea of evidence-based design but they prioritise the managerial practises over the evidently working technical solutions.

4.2 Paper II

The second paper investigated value co-creation in a context of learning space renovation project. In the field of built environment, it is not unusual that the focus is on the property and the product instead of the effect on user operations. This may lead to a situation of sub-optimisation where the building cost is optimised, while an increase in the operating costs leads to increasing total cost.

In case 3, a lunch restaurant at a university campus was renovated and converted into a new multi-purpose learning space using a participatory design method called charrette. Learning spaces are complex webs of different factors – physical, social, virtual, cultural, temporal, and psychological. In recent years, the concept of learning spaces/environments has been approached in a holistic way in order to describe the totality of the factors influencing the learning situation. The aim of this case study was to construct a holistic understanding of the benefits of collaborative working in relation to quality assurance of the final product by examining the participatory design process, observing space usage, and surveying user experiences.

The research questions were:

(1) How are the requirements for a space created during a co-creation process?

(2) How does the final product meet the users' needs that were conceptualised during the charrette?

(3) How did the service process answer the requirements of the end user?

A qualitative case study approach was chosen for this research because it allows the study of complex contemporary phenomena within their real-life context using multiple sources of evidence. During this case study, a 400 m^2 location was redesigned at the Department of Music of the University of Jyväskylä to better support the core activities of the institution.

Data was gathered systematically throughout the project. Data from the visioning and concept design phase (i.e. the charrette materials) drew a picture of what was planned together with the end users. It comprises meeting memos, designs, expert-evaluations, and summaries of discussions that offered user perspectives on space design, which were analysed using a predominantly inductive content analysis. Materials from the technical design and construction phases comprise all the memos from the project meetings, allowing the researches to follow the decision-making chain throughout the project and to find connections between the design and the final product.

The space utilisation was measured and qualitatively studied by video observation of how the space is being used. In addition, the booking information of the space was used. Video recordings were

conducted twice during the project using time-lapse cameras. Before any alterations, a four-day recording was shot in the space to be renovated, and a second video was shot six months after the implementation. During the first six months of use, user experiences were gathered using a survey. The survey included five open-ended questions regarding anticipated use of the space, atmosphere, positive and negative aspects of the space, and other comments. Surveys were placed in the renovated premises and were available to everyone entering the space. A total of 54 users answered the survey (48 students, five staff members, and one musician).

The content analysis of user needs resulted in three main categories: infrastructural, practical and emotional. The infrastructural factors refer to the fundamental underlying systems and services necessary for a built environment to function. Most of these factors stay hidden during conceptual design but they have an enormous effect on the usability of spaces. Usually, infrastructural factors are the ones users do not want to think about, meaning they are discussed only when they do not work. During the charrette, users developed three themes related to infrastructural factors: safety, facility management, and information sharing.

The practical factors refer to elements that are related to action. It comprises the key activities of the organisation – in this case, learning, teaching, and research. Practical factors included the following themes: information sharing as tools for teaching, learning, and creating music; new learning; new campus culture; and fit-out/lay-out.

The emotional factors refer to experiences through senses. They comprise visual, auditory, and tactile sensations, cognitive processes, and subjective experiences. The image of the new learning space was important from the beginning of the project.

The level of collaboration varied between the phases of the project. During the concept design phase, there was genuine enthusiasm for participatory design. Sufficient dialogue was facilitated by the dedicated co-creator consultants in multiple design workshops, the results of which were transparent to each stakeholder. The transition from the concept design phase to the technical design phase was actuated by moving from the creative workshops to regular meetings and from the creation of new elements to downsizing the scope of the project to remain within the budget. Cost cuts were necessary as the elaborated cost estimate revealed that the costs of the first version of the concept had almost doubled the budget. In the downsizing process, the user needs were prioritised with respect to the information gathered in the co-creation workshops.

During the construction phase, the project team's attention was mainly focused on the question of 'how to build' instead of 'how this will be used'. This was necessary to keep up with the schedule and budget, but it may have led to some hasty decisions. One example was the way the wire installations for the outdoor speakers were handled. During the concept design phase, the users expressed that music heard outside the building would be an important part of the new image. When the users inquired about the wire installations during the construction phase, the project team stated

that they would investigate the matter. In the next meeting, they stated that there would be no wire installations for the outdoor speakers.

User experience survey responses indicate that there really was a need for a multi-purpose learning space. A majority of the respondents (f = 43, N = 54) reported that they would use the new space in the future. Reasons given for the use were related to the location being near the library and the long opening hours. Also, emotional factors such as the atmosphere and comfort provided reasons for using the space. Some respondents specified that this new learning space was the only free and available space for students and student organisations.

The problem of understanding user requirements and transforming them into high-quality designs is a universal one that many industries have struggled with. The findings of this study provide a link between the user perspective and the project management. While every discipline and educational level has its own unique characteristics, the presented results can be used generally to improve the design of learning spaces from the users' point of view. The infrastructural–practical–emotional framework can be used to improve the management of design and construction processes.

Even though participatory design represents a high level of service, it is not a concept without downsides. The active role of the owner seems to lead to opportunities for co-creating value-in-use with users in the concept design phase. However, this case shows that the use of participatory design in the concept design phase does not necessarily guarantee success. The accomplishments can be undone in the later phases of the project as the user-centric approach might be lost. In this case, some features of the required quality were lost in the construction phase because the decision-making and supervision were fragmented. Thus, we recommend that if the collaborative design approach is pursued, it should be done with a strategy that implies how to maintain collaboration at each phase of the project and during phases when the customer has less to say.

4.3 Paper III

The aim of the research is to observe the barriers in communication between the construction project organisation and the user organisation. The focus of the builders and the users of the buildings may be very different from each other, and the same goes for the language they use. The perspective of the language used in everyday communication of building projects has not been widely researched. There are some studies about how cultural differences including language problems may make project management more difficult (Ochieng and Price, 2010), but the language barrier may exist even if the stakeholders have a common cultural background. The purpose of this research is to provide additional understanding about communication problems by studying the differences of the language and jargon that is used by the construction professionals and the users of the building.

The roles in building projects can be divided into two categories according to the purpose of existence: the users and the others. The purpose of all the others is to ensure that there will be premises to use, whereas the users' purpose in most cases has nothing to do with the existence of the premises. Premises are simply one tool among others and the user could implement its purpose in any other premises as well. Thus, the competence and jargon of the users have little to do with the competence and jargon of all the others. The purpose of existence also determines the focus of each stakeholder: the users focus on how the premises may be used, whereas all the others focus on how the premises may be built.

In case 3, at the University of Jyväskylä, Finland, 400 m^2 premises were retrofitted to better support the core activities of the organisation. Before the project, there was quite a popular lunch cafeteria there that was about to move to another building at the campus. All the other premises in the building were occupied by the department of music, so it was decided to develop the premises to support learning, presenting and exploring music.

The co-creational project is divided into four phases that follow each other: visioning and concept design, technical design, construction and premises in use. The visioning and concept design phase of the project comprises the initial meetings with the key stakeholders and the charrette co-creation workshops. The technical design comprises the steering group and design meetings. The construction includes both construction and final planning ending with the handover. After the premises were handed over from contractor to users, the use phase began.

Various types of data were gathered systematically throughout the project to examine the whole process: charrette material (data produced during design workshops), memos and minutes and satisfaction survey. The survey was designed so that on one side there were statements that evaluated the premises' fitness for the activities it was designed for (fitness for purpose). On the other side, there were statements that assessed the success of the design and implementation as well as in-

cluded five open-ended questions regarding the possible use of the space in the future, the atmosphere of the space, the positive and negative aspects of the space and other comments. That way it was possible to observe differences in satisfaction expressions between the evaluation based on activities (users' language) and the design and implementation quality assessment (builders' language). A total of 54 users answered the survey. The majority (f=32, N=54) of the respondents were students from the Faculty of Human sciences, which includes the Department of Music. Altogether, 48 students, five staff members and one musician completed the survey. The analysis of the multiple choices was conducted by applying the logic of Net Promoter Score (NPS). NPS is developed by Reichheld (2006).

In the document analysis, three enlightening examples were identified to present the nature of the language barrier between the users and the construction professionals: curtains, fire detector system modification and outdoor speakers. Common to these three examples is that users requested all of them in the technical design meetings, but only the fire detector system modifications were delivered. Curtains were discussed in the design meetings because blocking the windows was considered as a vital part of the acoustics. There was a written statement in the minutes that the acoustical curtains will be included in the construction contract. The curtains were also presented in the contract drawings but they were not delivered in the handover. The story is quite similar to the outdoor speakers that were initially included because it is important for the department image that they have the option to play music from the stage straight to the surrounding outside area. The procurement responsibilities were shared so that the users had responsibility to provide the speakers and the contractor had responsibility to install the cable and arrange the demolition and fix-up for the cable route. Both the speaker cable and the curtains were installed after the handover.

The story of the fire detector modifications was a bit simpler. The modification for the detector was needed because the artists wish to use theatrical smoke at the stage. It was stated that this can be done by changing a couple of detector units and adding a module to the central unit of the system. The modifications were implemented according to the plan. When comparing these three cases, the question arises whether this is random behaviour to accomplish some assignments and ignore others or not.

Answers to the open-ended questions of the survey were divided into three major categories: infrastructural, practical and emotional. Emotional factors, which refer to experiences through senses by comprising visual, auditory and tactile sensations, as well as cognitive processes and subjective experiences, were mentioned 140 times in the satisfaction survey. Practical factors, which refer to elements that are related to or resulting from action, were mentioned 117 times. The infrastructural factors, which refer to the fundamental underlying systems and services necessary for a built environment to function, were mentioned 8 times. Based on these proportions, it is suggested that the users prefer discussion that focuses on emotional and practical factors instead of focusing on infrastructural factors like the quality of indoor climate.

Another indication of the significance of the language used can be found in the multiple-choice questions. When comparing the first survey answers to the second survey answers, the change in the proportion of the best grade answers (5, meaning “I completely agree”) is striking as the following discussion reveals. The development from the first survey to the second one is opposed between the question sets. The satisfaction seems to increase in the set that evaluates the usability of the premises (fitness to purpose) and decrease in the set that assesses the quality of design and implementation. The logical reason was searched for in the terminology, and it seems that users are more capable of evaluating if the question directs them to consider activity first and space second, as was the case in the first set of questions. Instead, the second set directed them to consider space first and the effect on action second.

Our three examples of how user needs were treated during the design and construction phases (curtains, fire detector system modification and outdoor speakers) indicate that construction professionals tend to deal only with the features related to the infrastructural needs. There was no significant difference between these three tasks schedule-wise or budget-wise. Neither was there a difference in how they were stated in the meetings. It was made clear that all of these are important for the user. The need for the fire detector system modification was related to infrastructural needs, whereas the other two were related to practical and emotional needs.

If the infrastructural needs are compared with the other two categories, it can be realised that engineering safe and healthy indoor climate differs quite a bit from designing how the premises affect human behaviour or human emotions. It may be that most of the engineers would prefer only to deal with the infrastructural needs: the outcome is much more predictable and needs fewer adjustments afterwards. That way the engineer can be sure about the value he/she has to offer. But the downside is that the service and the terminology concerning the practical and emotional needs remain underdeveloped. As the oversimplification of the communication problems is supposed to be malicious, these problems will require a lot more research in order to find ways to offer services not only to the infrastructural level of needs but all user needs. Therefore it is suggested that project management service providers could gain significant competition advantage via better understanding of needs.

4.4 Paper IV

The purpose of this research is to better understand the connection between design management procedures and quality. Even though there is quite a lot of collaboration-related research concerning construction project management, the focus is quite tool-oriented. Focusing on a single tool or practice makes the perspective rather mechanical, which reduces human existence to a couple of quantitative indicators such as units-per-man-hour, safety, cost, rework and so forth.

To reach a holistic vision of how to improve the total quality of the project delivery, indicators of collaboration per se are needed. The argument is that the project quality performance can be forecasted from the project management procedures. To prove this, user satisfaction was used as quality indicator, and an explanation for satisfaction level was sought by qualitative analysis over the project documentation.

To complement reflective indicators like process variances or design quality indicators, this research analyses collaboration from the perspective of formative indicators. In general, the indicators may be divided into two categories: reflective indicators and formative indicators. Reflective indicators are based on the classical test theory. They assume that every measure reflects an underlying construct, i.e., the object under examination. On the other hand, formative indicators are used to describe more complex social constructs. Socio-economic status is a classic example of such construct, as it is formed as a combination of education, income, occupation, and residence. Thus, as the collaboration is a multifaceted social construct which has multiple dimensions, it is suggested that the formative perspective is suitable for this research.

Mixed-method approach which entails both quantitative and qualitative data collection techniques and analysis procedures was adopted as main research approach of this study (Saunders et al. 2009, p. 152). The quantitative survey was conducted among the users of the premises that were renovated in the case project. The approximated size of the target population was 200. A total of 49 users answered the survey, and 43 of those answered all questions. The qualitative component of the study was an archival analysis over project meeting memos, project schedule, project budget and cost calculations, workshop material such as drafted drawings, and video-recorded presentations of users.

Case 5 was a renovation project where a 300 m^2 learning environment, a rehearsal newsroom, was renovated to match the needs of new media environment. Since the previous renovation of the premises in 2005, the focus in the journalistic media has moved from print and desktop-oriented production and consumption to ’mobile-first‘ and a more audio-visual approach. All this required high-tech wireless transfer systems for both internet connections and AV contents, and that made the project technologically challenging to design. In addition, there were ventilation and piping changes, and the building automation was also modified. Therefore, a full designing team was commissioned for a

small-scale project, and that made the case suitable as a critical case for researching the collaborative ways of working.

As a result, four indicators were identified may be capable of explaining how project outcome quality can be forecasted from the management style and managerial acts. To create a useful formative indicator a set of sub-indicators must exist that cover the examined subject. In Figure 8, the identified four indicators are presented as sub-indicators to the status of beneficial collaboration. Thus, the beneficial collaboration is understood as main indicator, which forecasts the quality of the project's outcome.

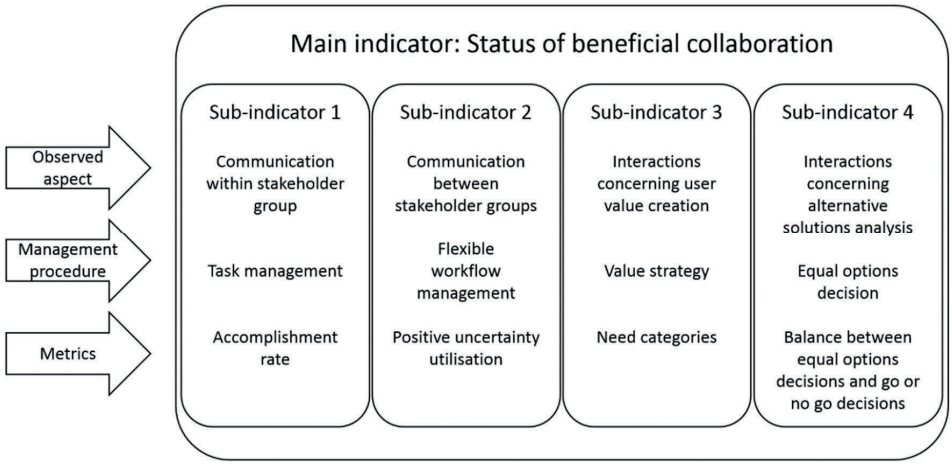

Figure 8. The breakdown regarding the indicator of beneficial collaboration.

The first sub-indicator is task management, which observes communication within each stakeholder group. Task management follows accomplishment rates of the task lists and keeps up the design schedule.

The second sub-indicator observes communication between stakeholder groups and the flexibility of the workflow management. The flexibility is observed by recognising utilisation of beneficial uncertainty from the following aspects:

1. Increasing creativity
2. Constantly adopting more perspectives
3. Increasing maturity of information
4. Task prioritisation
5. New solutions suggestions

The third sub-indicator observes interactions concerning value creation by examining whether the management possesses a strategic perspective to value creation by fulfilling user needs. The strategy is supposed to be formed by recognising user needs related to categories of infrastructural needs, practical needs, and emotional needs (detailed description available in the summary of paper II). The results of the satisfaction survey suggest that a high level of satisfaction is reached by fulfilling strategically determined emotional needs and those practical needs which are closely related to emotional needs and thus support the effects. Infrastructural needs should also be fulfilled, but the role of these needs regarding to the customer satisfaction is slightly different compared to practical and emotional needs. In the fulfilment of infrastructural needs a modest performance does not prevent reaching a high satisfactory level, if the practical and emotional needs are successfully met.

The fourth indicator reflects the decision-making style in the project. In the analysis, it was observed that there were two different decision categories: go or no-go decisions and equal options decisions. In a go or no-go decision, the preparations were made for the chain of command, and the purpose of the preparations was to make an easy decision to continue the project as planned. In equal options decisions there were no obvious ways of how to carry on, and the purpose of the preparations was to analyse the effects of each option. A combination of these was found to be both an analytical and effective way of making decisions, as lack of the first would have led to hesitative inefficiency, and lack of the latter would have resulted in command and control style of management, where the existence of only one solution is allowed. In the analysis, four criteria were found to distinguish whether both elements are present.

1. Information basis
2. Transparency
3. Power sharing
4. Ability to iterate

The combination of task management, flexibility of workflow management, value strategy, and alternative solution analysis form an indicator that forecasts whether the project management style leads to high performance in quality. The practical relevance of the indicator comes from the notion that it can be used already during the project to forecast the quality of the project. This is a significant difference compared to quality control inspections but more research is needed to understand for example the relative importance of sub-indicators.

4.5 Paper V

Process ontology shifts the focus of research from stability and control to change and the unknown, putting on-going action and emergent activity at the forefront of inquiry. Blomquist et al. (2010) argue that while projects are in a traditional view formed through a series of pre-planned, step-by-step and controlled processes, the project management literature increasingly recognises that managing a project involves managing movement and transformation, that is, dealing with human interactions and reacting to changes. In this article, we aim to advance a conceptual framework that further refines this kind of an emerging process.

We build on this view and assert that to understand the fine-grained nature of what happens in and during a project we need to recognise and be sensitive to the 'vibrant movements' of the microactivities in the process. We study this idea from Gadamer's (2004) play ontology perspective. The play ontology refers to how a phenomenon, a project in our case, is more like a wave—experiencing back-and-forth movements in response to varying weather conditions—than an entity operating in a vacuum.

Our case materials are drawn from an office renovation project undertaken at the University of Tampere, Faculty of Management, Finland. The owner, University Properties of Finland Ltd (UPF), had initiated a DEMO program to develop new types of learning and working environments in universities. The aim of the project was to renew the office environment (approximately 550 m^2) to meet the current needs of academic work by engaging the users of the space to co-design the project. The co-authors of this article served in different roles in the team. One acted as the project manager (PM), another was the main facilitator of dialogues among the users in the workshops and the third worked in the space and provided information based on ethnographic observations, informal conversations and accounts of self-organised re-design activities during the project.

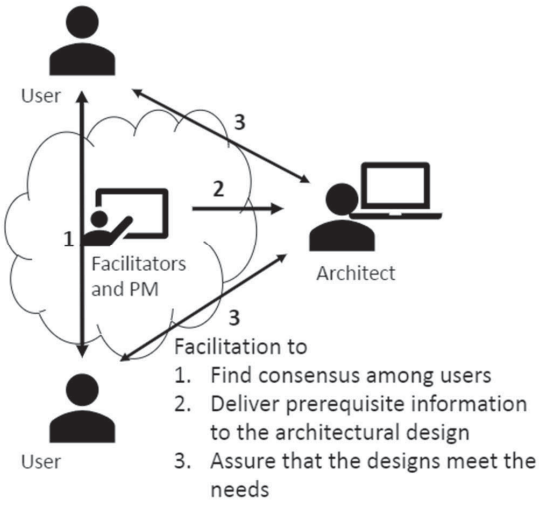

Figure 9. Facilitated dialogues in the project.

Data collection and analysis applied organisational ethnography methods and a hermeneutic approach to materiality. In particular, we followed Yanow (2010) in 'giving voice' to academic practices. The method and the analyses were developed step by step and had elements of interactive, flexible research design, including all the necessary phases but not following a certain order. The theoretical framework, objectives and questions of the study became more focused throughout the process. The first concern was to collect materials that were as rich as possible throughout the project. We did this by videotaping workshops, conducting interviews, participating in events and observing end-users' activities in the space before, during and after the project. Because of these continuous reconfigurations, we began to reiterate the research design after the actual project.

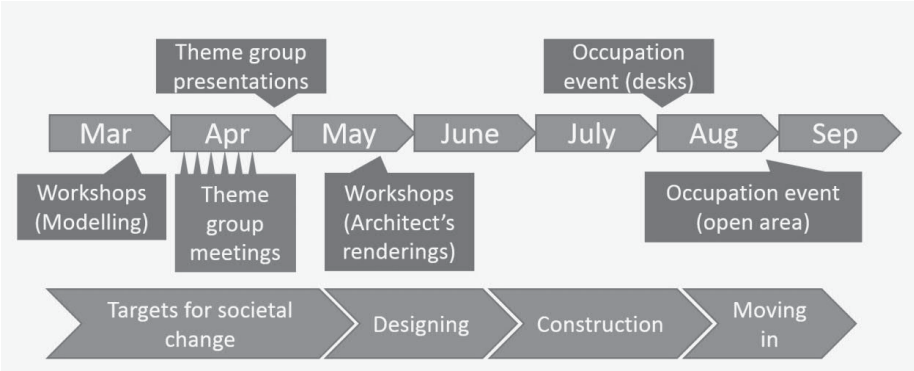

Figure 10. Timeline of the project.

From the various materials, we constructed two types of process narratives from a practice perspective. The first round of the analysis describes the chronology of the project (Riessman, 2008). It represents the playful practices of the project in three vignettes, relying on the key phases of the project. Following Riessman's definition, these narratives are structured around the events, displaying the events in a chronological order and including causal links. We consider the vignettes as windows on the project practices. The first vignette describes how the users play with different ideas, desires and needs by building miniature models of the imagined office space. The second vignette introduces the architect's play, with various renderings based on the user information. The third vignette describes the phase when the users moved into the new spaces after the construction and their play with furniture and artefacts as well as their current views and desires concerning the space. The three phases of playful processes described below are intended to highlight the emergent process of the project.

A. Modelling the space. The workshop agenda consisted of three items: the interview summary, a discussion of office design benchmarks from around the world and the creations of mock-models of the future workspace.
B. Architect's renderings the architect was invited to join the workshops as a silent partner. He did not participate in the discussions but kept inspecting the wall constructions and studying the current layouts and the technical structure of the materials. He was not asked to draw a layout for several months. Finally, in late May (several months after the beginning of the project), he drew several scenarios in one week that all included the three main functions that the end-users had come up with while prioritising their desires in the theme groups: a quiet workspace, a communal lounge and private meeting spaces. The architect presented the first four scenarios to the end-users. All agreed that none of them could be the final solution. However, they introduced a common language for talking about the space, its possibilities and challenges.
C. Moving in to the renovated space. The day in August 2016, after summer vacation, when a number of participants gathered to see the new spaces, was an anti-climax. Hopes were high when they entered the newly renovated and opened spaces, but the sight was bleak. The communal space lacked furniture, and the two new open workspace areas were full of furniture (high cabinets) that seemed inappropriate and unnecessary. The risk had realised: they had not been able to communicate their ideas to the architect in the right way. Soon, they started to re-assemble the furniture, moving it back and forth and trying out different layouts. In that moment, they were caught up in enthusiasm, energy and playful experimentation, much as they were during the modelling phase; now, however, they had tangible furniture and materials to focus upon. The end result was unknown, and what the space might look when they came to work was always a surprise. Some furniture might be in new places, just to see how it felt. The space was continually reshaped as they tried different experimental layouts—and this process is still continuing.

The vignettes described above depict the renovation project phases unfolding over time. Next, we will elaborate in more detail on how some key features of the process emerged as a play of micro-activities: first, how the end-users came up with the term ‘nest’ to illustrate the physical and emotional space they wanted to work in and how the term manifested itself in the architect’s layout and was experienced by the end-users while moving in. Second, engaging students in the project and seeing them as part of the spatial practices developed as a marginal discourse, in the side-lines of the whole project, yet the collective agreement in favour of inclusion was an easy, clear-cut decision. Third, space for exercising and stretching was a central topic in the project’s microactivities at the beginning of the project, but it gradually faded away. The play among microactivities in these instances thus had different intensities over the course of the process.

Our point here is to illustrate that whereas the continuously emerging microactivities are a nuisance from the traditional PM’s perspective, from the end-users’ perspective, they represent an organic accumulation of knowledge. We term the back-and-forth considerations in theoretical discussion ‘vibrant movements’. They indicate that an issue, when not ‘killed’, is alive and evolving as a social construct. In terms of play ontology, this evolvement is not an exception or anomaly but an elementary ontological characteristic: the topic is furthered, and thus its ontology is, by nature, processual. As evidenced in the vignettes, the microactivities around the three chosen topics (nests, student engagement, exercise equipment) carry over several project stages.

Using play ontology, we identified three moments that add to PM theorising on decision-making in projects. First, there is silent acceptance. This occurred in the case of ‘student engagement’. Here, the playful movement had begun with informal discussions—some individual comments on opening the space for people beyond the staff (weak signals)—and these topics reappeared and strengthened during the process without notable objections. The ontological status of this vibrant movement became apparent when the promoters offered a concrete suggestion about how things should change and no one objected.

The second moment is abandoning an idea, which occurred in ‘space for exercising and moving’. This idea was greeted enthusiastically in the first workshops, and it was discussed as a good idea for a long time. However, after elaboration the users decided that such a space would be redundant. Since nobody objected to this judgement, the idea was essentially abandoned, although a pair of wall bars was added afterwards. (Note: as one of us was hanging from the bars about a year after the renovation, a passer-by commented that he was the first person she had ever seen use the bars.)

The third identifiable new moment is the inability to develop further without additional information, which occurred in the ‘nests’ example. This was evidenced when users could not provide more precise comments on the final furniture plan of the open plan office layout. This was interpreted as an inability to form an opinion, even though the users had expressed strong opinions concerning the

nests in the previous conversations. Once the furniture arrived and had to be reassembled, it became clear that neither the end-users nor the architect were able to mentally figure out how the space would look and feel. It is possible that even 3D modelling may not have helped, although it could have shown the height of the closets in the middle of the room more clearly. Here, play ontology is a useful concept for describing the flow of events, although in this case the back-and-forth movement was not yet finished. However, this was only realised after the finished design was revealed.

Lastly, in practice the project managers occupy an ambiguous role between various interests and groups. PM's own organisation puts pressure on the project because despite all the changes that occur, the project needs to stay on schedule and within the budget – the way it has been sold. This anxiety, as we have called it above, explains the difficulty of PM to listen to, interpret, and be sensitive to microactivities. As described, in terms of play ontology some issues develop in repetitive patterns, and this might be particularly frustrating and anxiety-provoking for the PM who aims at keeping track on major decisions and project phases.

5 Conclusions

5.1 Summary of the results

In this chapter, the results of the inductive reasoning process are presented. As the purpose of the inductive approach is to build emergent theories, this dissertation proposes novel logic for value creation in design process. In the development of value creation logic in user centric design, the epistemology and the empirical observations of this research have been combined with Juran and Godfrey (1998) conception of quality and Grönroos and Voima (2013) conception of value.

The epistemology of this research is based on the interpretivist research philosophy. Design management is studied as a socially constructed phenomenon, and the data lies in interactions between social actors i.e. the stakeholders of the project. In this research, the examined interaction is communication, and therefore focus is set on information flows between the stakeholders.

In communication between stakeholders, a stakeholder creates information and transmits it to another stakeholder, who receives the information, utilises it in its duties i.e. uses it to create new information, and may give feedback to the first stakeholder who receives the feedback. After the information has been created, there are certain pitfalls in the process, where pieces of the information can be lost. First, the information can be lost when it is modified to transmittable form; second, it can be lost because of misunderstandings when receiving the information; third, it can be lost if it is only partially utilised in creating new information; and fourth, it can be lost, if feedback is not given and received appropriately. The key stakeholders and the key interactions between them are depicted in Figure 10.

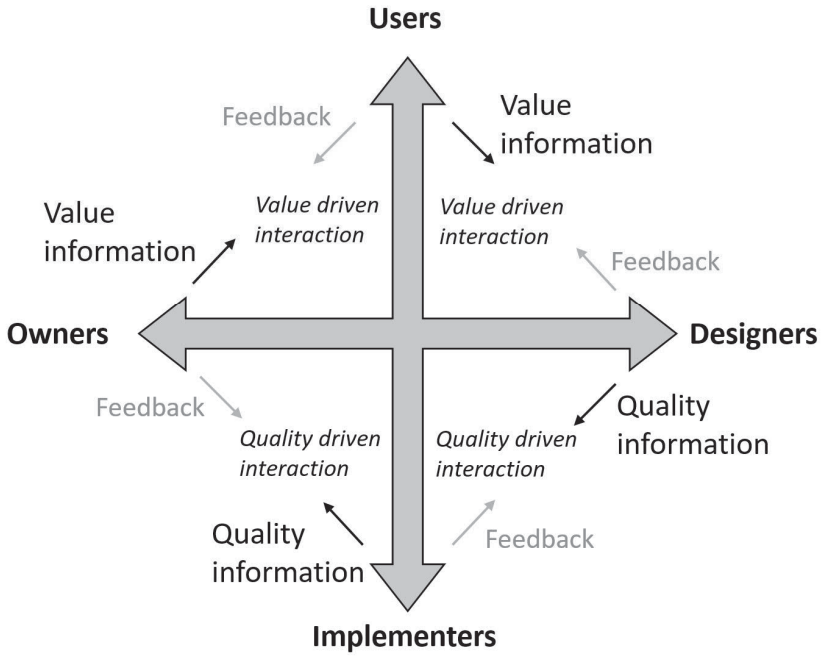

Figure 10. Key interactions of construction project

Grönroos and Voima (2013) defines value as value in use: value is created by user during the usage of resources and processes. This definition creates an imminent problem for the existence of the value of designing: how can value exist in design phase, if it is created in testing and using phase, i.e. later than design phase? A similar problem occurs with the Juran and Godfrey (1998) definition of quality with dual meaning: on one hand, quality is those features of a product that meet customer needs, and on the other hand, it is freedom from deficiencies. How can product features meet the customer needs if the product itself does not exist yet?

For these reasons, it is necessary to separate the concept of value information from the concept of value per se and the concept of quality information from the concept of quality per se. The information of the concept, like anticipations and ideas, may exist before the concept itself actualises. Another possibility would have been to separate concepts of design value and quality from the concepts of product value and quality, but the empiric evidence of this research does not support this reasoning. The users do not gain benefit from the designs without implementation, and therefore it is suggested that the value or quality do not exist independently in designs.

The discussion of the results is structured as follows. First, the emergent logic of value creation in user-centric design is introduced. As a part of logic description, there is determined emergent terminology which is applied in the answers to the research questions. Second, the answers to the research questions connect the empirical observations to the logic and describe the process, which resulted in the emergence of the logic. In the analyses of the cases, there have appeared wide range of observations regarding design management practices. However, the purpose of this summary is to answer the research questions, and therefore only the most relevant and the most enlightening examples have been brought up. Third, the contribution to existing literature is discussed.

To follow the tradition of reporting the case study results, the answers are written in the form of observed patterns. These patterns with the related argumentation form the basis for the contribution to the existing body of knowledge, and the discussion of the contribution follows subsequently. The place of the discussion, after presenting the results and conclusion of the study, is according to the Eisenhardt (1989) roadmap of inductive theory building. According to the roadmap, the comparison with the relevant literature is done in the final stage of the process. The purpose is to seek theoretical saturation by combining the emergent reasoning with the existing body of knowledge.

The final sections of this book discuss the reliability and validity of this research, and views the potential research topics for the future.

5.1.1 Value creation logic in user-centric design

The value creation logic in user-centric design is an emergent concept, supposed to help design managers to focus on the right issues when managing a design process. It comprises 12 principles which may be used as guidelines for design management. These guidelines are supposed to help to recognise opportunities to enhance value and quality. The rationalisation behind the logic and the connection to empiric observations are presented in following sections.

1. Value is created by user when using, and therefore the users are the primary source of value information.
2. Value information in design means the anticipated ways of creating value, for example the anticipated needs that are supposed to be fulfilled, or agreements on the prioritisation of the user needs. Value information is dynamic in nature, not static, and therefore value information may increase or change during the project.
3. Value as such is not created in design phase; it is created in using phase. Therefore, co-creation in design phase, like participatory workshops, creates value information, not value. Designs influence value creation only if they are implemented and used as anticipated.
4. Designers do not create value but they influence value creation by:
    - absorbing the value information and using it in designing

- giving information which helps users to create value information, like helping them to process or prioritise needs
- giving information which helps users to create value, for example, helping them to understand how to use their current or the upcoming premises more efficiently or better in some other way

5. Quality information denotes producer's conception of user needs, and the conception of how they are met with product features. Quality information contains two components:
   - 'What' component: What does it do? What happens when it is used)? 'What' component determines the action, reaction or interaction that satisfies the user need(s)
   - 'How' component: How does it work? How is the required action achieved? How is assessed the performance? 'How' component determines how the capability of the 'what' component is built, and how it is promised to work.
6. Quality as such is created in neither the design phase nor the implementation phase; it exists only in relation to value. True quality, "fitness to purpose", is assessed in use, not in assessments prior to use. Ability to promote quality in design and implementation phases depends on the correctness of the value information that is available.
7. Promoting quality means resolving issues that the two components address. 'What' component should be resolved by using value information, otherwise the design is based on designer priorities instead of user priorities. Designers and implementers (e.g. contractors) can resolve issues related to the 'How' component only if issues related to the 'what' component are successfully resolved.
8. If value information is discussed, the interaction is either value-driven or quality-driven. Value-driven interaction includes user as participant, whereas quality-driven interaction excludes users, and value information exists as conceptions of other stakeholders.
   - Value-driven interaction contains topics such as:
     - What needs should be fulfilled to maximise value
     - How to prioritise different users' varying needs
     - How to receive best value for money
   - Quality-driven interaction contains topics such as:
     - How value information should be interpreted as requirements for the product or service?
     - What kind of technology and suppliers are needed to meet the requirements? Do we have options? What is the cost of each option?
     - Is the design flexible for value information changes?
9. Creativeness in both type of interactions can be enhanced. Copying a well-known working solution is considered as level zero of creativeness. Creativeness can be advanced by enabling free speech, giving people time to think, and letting them to get inspired from other people's good ideas and building on them. Forcing hasty and harmful decisions is negative creativeness.

10. In value-driven interactions, a creative solution is one that challenges the current way of acting in the premises and replaces it with one that creates more value. More value may mean either more productive ways of working without compromising the user-friendliness or more user-friendly ways of working without compromising productivity. In the best case, both aspects are enhanced. The cost and feasibility should be assessed after the creative discussions have saturated.
11. In quality-driven interactions, the creative solution is the one that challenges the current link between user needs and a typically offered product or service. The link can be challenged by questioning whether satisfying the user needs requires all the features included in the typically offered product of service. If not, then it may be possible to satisfy the needs by a less costly solution, i.e. in a more cost-efficient manner. Another way to challenge the link is to examine, whether more needs could be satisfied by slightly varying the typically offered product or service. This approach is needed especially in cases where users have created new ways of acting in the premises. In those cases, new user needs have been identified, and the way of satisfying them should be examined.
12. The first solution is rarely the best one. Therefore, iterations are recommended.

5.2 Answering the research questions

The logic introduced above is developed in an iterative research process, the aim of which has been answering two research questions. The iterative nature means that the process can be viewed as cycle, where literature reviews, data collection, and analysis have been made in turns, partly simultaneously, and repeated within the same case or in the next one. There have been three main phases in the process: recognising collaborative ways of working, repeating the best practices, and elaborating the practices.

The analysis in conducted according to Yin's (2009) instructions for case studies: the answers to the research questions are formed from patterns that are repeating from phase to phase, or have been predicted prior to data collection. The pattern descriptions provide a transparent explanation on how the value creation logic in user-centric design is rationalised, and present the practical implications for design management. In both answers, the phenomenon is studied from two perspectives, first from the 'user need' perspective, and secondly from the 'loss' perspective. These perspectives are present in both value and quality literature, as the existence of both value and quality is related to user needs, and the concept of loss is understood as a negative counterpart to both value and quality.

5.2.1 RQ1: What creates value in design tasks of construction project

Following the introduced value creation logic, the obvious answer would be "nothing creates value in design tasks". However, design tasks may significantly influence the users' ability to create value

in the events prior to value actualisation. It may have been stylish to modify the research question afterwards to meet the emergent logic, but the author chose to leave it as it is because answering this question in its current forms may prevent some obvious misunderstandings in future research. The author hopes that answering this question underlines the difference between value information and value: value information can be created and managed in the design phase.

5.2.1.1 Influence the user focus

The first identified pattern explains the causality between value information dialogue and scope adjustments. The value information dialogue between users and designers is iterative information exchanging, where users first create value information by explaining their suggestions on the value actualisation in use situations. Then the designers use the value information to create quality information i.e. design the premises, and finally the designs are used to give feedback to users. The feedback may initiate a new iteration if users utilise the feedback for creating new value information or correcting the previously produced value information. Moreover, new value information may cause improvements to the designs and a new iteration initiated. This iterative dialogue is continued until value information creation has saturated in this interaction (between users and designers), and the focus is then shifted to the next interaction (between designers and implementers).

In the first phase of the research process, recognising collaborative ways of working (cases 1-4), different arrangements were tested to see how to provide an opportunity to users to create value information. In case 1, the users had a meeting in the beginning of the project where they could state their wishes, and the architect of the project documented these wishes. In case 2, the users had three full days of participatory design workshops with two professional facilitators who analysed and summarised a vast amount of user opinions and ideas. In the end of the workshop series, the architect drafted a layout design to be assessed by the users. The quantity surveyor (the author) calculated a rough cost estimate based on the layout draft, and a prioritisation discussion among the users was facilitated. The procedure in case 3 was similar to case 2 with the exception that there were five workshop days and the quantity surveyor (the author) acted as the design manager in the later phases of the project. In case 4, there were premises in two separate buildings, and two half-day workshops were arranged for both of them. The project manager (the author) took care of the facilitation of the workshops, quantity surveying, and design management.

The observations of the first phase revealed that the quality of the dialogue between users and designers was more important than the users' person-hours spent in creative workshops. Obviously, more person-hours meant more ideas but, from a perspective of a single project, the saturation point of feasible ideas is more meaningful than the saturation point of all ideas. Therefore, in these small scale projects two half-day workshops created a sufficient amount of value information. Instead, if the purpose had been to create far-reaching vision for the whole campus, the multi-day series of workshops would have been the appropriate scope.

One of the key observations in the first phase was that merely listening to the users did not guarantee the best results. Feedback is an essential part of the dialogue that commits users to the project, and users expect to receive feedback from the value information they have produced. They want to see the effect of their contribution on the designs and the project's feasibility. Therefore, the two half-day workshops were considered as the minimum scope of creative actions. It takes some time to prime people into an open and creative mood but, on the other hand, they get exhausted in intensive creation. When there are two sessions instead of one, and the produced value information is analysed between the sessions, it is possible to stimulate the users' creativity with suitable feedback.

In the second phase, repeating best practices, (case 5), the value information dialogue was similar to case 4 except that only two half-day workshops were arranged, because there was only one building instead of two. In addition, the stakeholder committing procedures were elaborated by using the experiences from cases 2 and 3.

In cases 2 - 5, cost estimates and layout drafts were delivered to users as a feedback. This was found to be useful way to make users think about the project and commit them both to the communication routines and the outcome of the project. However, it was also observed that the users did more than merely prioritised functions and compared price tags: they tried to anticipate new practices and conducts.

In the third phase of the research, elaborating the practices (case 6), the focus was shifted from the information to user experience. As in the project, the users developed new practices and conducts as well as the premises, and it was considered equally important to study the creation of the value information from the perspective of social environment in addition to built environment.

The design process was modified to give users time to think and to create an idea of a new social environment alongside the creation of a new physical environment. The idea of the modifications was to recognise ways of giving users the kind of support that would enable them to discuss new conducts and social practices. The expected outcome of the modifications was that the user satisfaction would correlate more with the amount of recognised and satisfied user needs than money spent on the modifications. It was also expected that the user needs would be vague concepts only until they are discussed and agreed on. Therefore, the existence of user needs is better described as a social construct that will find its form during the project rather than something that exists as a 'downloadable' entity in the beginning of the project.

This assumption changed the logic of how the design advances toward implementation. Traditionally, the designing advances from inaccurate conceptual plans toward accurate work designs. The level of detail is increased as the time passes. In the new system, the designing moved on step-by-step following the chances to support dialogue among the users, and the roles of the architect and project manager were quite equal to other discussion participants and not that of professionals leading the design process. For example, the first layouts the architect presented to the users were deliberately

made to exaggerate certain features that the users had emphasised in earlier discussions. These exaggerate versions helped users discuss different options and the effects of the premises on the social environment.

The notable difference in feedback compared to the earlier phases was that no detailed cost information was given to the users. The feedback was delivered in the form of designs which were explained and used as an introduction to value information creation. The focus of the discussion was on each design version impact on the desired social environment. In the earlier projects, the focus was on built environment and related cost estimate, and therefore the users assessed how to get most desired features of built environment while adjusting the project to fit the budget. Instead, when the focus was on the impacts on social environment, the users described the desired social environment and assessed the potential impacts of built environment. This was considered to provide direct access to understanding user needs, which enabled the use of low-cost solutions as long as the needs were met. This approach saved a considerable sum of money and resulted in outstanding customer satisfaction.

The first pattern of the impact of design tasks on value is that the value creation is influenced by influencing the user focus. Any feedback given by the project team will influence the focus of the users in adjusting the project scope. If built features and costs are provided as feedback, then built features and costs are optimised. If societal impacts are provided as feedback, then desired societal impacts are maximised. Both of these methods are recommendable compared to blind cost cutting without considering value, but in some cases, the societal impact approach may provide chance to have big impact with small costs.

5.2.1.2 Combine value information and commitments

The second identified pattern explains causality between user commitment, amount of value information available in design phase, and problems occurred in later phases. It was recognised that the lack of user commitment is a major risk for project delivery.

Case 1 was the only project in which there was significant delivery delay, as the project schedule was exceeded by three months. It was also the most complex project in this sample. However, the main reason for the delay was hindrances in the design and delivery of the audio-visual systems, which required plenty of information from users. In case 3, there were also complex audio-visual systems but the users took much more responsibility for the design management and procurements. The suggested explanation was that the users were better aware of their responsibilities because they had participated in the workshops in early phases of the project. In addition, they had committed themselves to the project by participating in the discussion of cost and prioritisations.

Properly facilitated participatory workshops combined with a discussion on a rough cost estimate was suggested as a way of preventing major problems in project delivery. However, no major advantage was observed in cases 2 and 3 compared to case 4, even though there was a lot less time spent on participatory workshops in case 4. Cases 2 and 4 were delivered in schedule without major problems but in the project handover meeting of case 3 there was a long list of observed deficiencies in the contractor delivery. However, the user group of case 3 had established a routine of user meetings in the design phase, and therefore they were able to arrange a crisis meeting to take corresponding actions. Thanks to user initiative, the premises were ready for use in the beginning of the semester as planned.

The second pattern of the impact of design tasks on value is that the risk of major problems in project delivery will decline with a sufficient amount of value information combined with committing management routines. The potential sources of loss are insufficient value information and value information not reaching the right people in the right form. The pattern was verified in case 5 by taking the committing management system from case 4 and assessing the sufficiency of value information with the emotional – practical - infrastructural (EPI) categorisation developed in researching case 3.

5.2.2 RQ 2: How should collaborative ways of working be managed to enhance quality of designing in a construction project

As discussed above, the term quality refers to the producer's perspective, and therefore this question is answered by explaining how the management of the project team should be approached to enable beneficial collaboration. The answer contains two identified patterns: first, to describe the effect of well-managed collaboration on satisfying customer needs, and, second, to describe how to prevent deficiencies in the project delivery via well-managed collaboration.

5.2.2.1 Focus on quality of interaction instead of information coverage

The first identified pattern explains the medium of the collaboration management. The managed aspect is interaction instead of information. Creating value information, giving feedback, and producing quality information (i.e. designing according to the value information) are all important tasks, but in construction projects, it is pointless for several reasons to try to manage all the information flows. First, even in these small-scale projects, there are numerous producers of information, and their relative importance notably depends on the context. It is impossible to draw context-independent rules for information flows.

Second, information is transferred in multiple channels of which some are properly documented and some are not. Both formal and informal channels are important for the success of the project, and therefore it is recommended to enhance the use of informal channels to ensure that all necessary information is transferred instead of blocking them and demanding control. People tend to circumnavigate the official protocols to get the message through with the least effort, for example, they

exchange at least as much information in informal discussions and phone calls than in formal meetings to get information instantly delivered to the persons who need it.

Third, it is much easier to sense the quality of interaction than to ensure that all information is delivered. If a project manager aspires to manage all information, a significant amount of responsibility is taken away from other team members. Instead, if the project manager's objective is to enable open and trustful atmosphere in the key interactions, that responsibility is shared. This was the logic in the committing management procedures in the cases.

In the first phase of the research, it was considered that it is useful to establish a formal meeting routine for each key interaction (user-designer, designer-implementer, implementer-owner, and owner-user). The idea was to ensure that all relevant information is delivered in the right order, and that everybody knows what to do with it. However, the formal meeting procedure proved to be unnecessarily heavy. In some interactions, it was good to have monthly meetings, whereas in other interactions it was more appropriate to manage interaction mainly by e-mails and phone calls, or merge the meetings of two interactions. The appropriate management procedure depended on the phase of the project, for example, in the early phases of case 4, it was necessary to have several meetings, where users, designers, and owners were present. In the implementation phase, in contrast, owners were kept informed by monthly reports, designers visited the site at the request of contractor, and users were contacted if there were design changes that required comments.

After all, the interaction pattern helped to recognise information needs, although the management procedure needed more customisation than expected. In the second phase, the system was updated. Instead of having a formal meeting procedure for all interactions, the focus was set on observing the quality of the interaction and ensuring that formal procedures to document important issues are in place. In the study regarding case 5, four indicators were identified that may be used to assess quality of interaction (these are explained in more detail in paper IV). By assessing quality of interaction instead of information flow, the manager assesses the following aspects in the relationship between two stakeholders:

- First, ability to recognise and communicate what information is needed
- Second, ability to agree, what information will be delivered, in what schedule, and in what form
- Third, their ability and willingness to understand each other and the purpose of the project
- And finally, their ability to prepare issues for third parties, e.g. for owner to make a decision

Thus, the manager does holistic assessment over the stakeholders' competences to accomplish the project goals and motivation to collaborate instead of merely assessing prerequisite information.

To elaborate this, in the third phase of the research the focus was set on emergence of value information as a processual phenomenon. In case 6, the objective was to study how users initiate, modify and verify the value information, and how this process can be managed. It was considered utterly

important to understand in which stage the emergence of value information was, as otherwise the managerial actions could lead to hasty decisions. Especially, if the design instructions are given based on unverified information, users may request design changes that could be avoided by waiting for verified information. On the other hand, if designers wait for verified information in a situation where users cannot provide verified information, the project may suffer from unnecessary delays of designing. Interpreting these kinds of situations is discussed in detail in paper V.

The first pattern of managing collaboration to enhance design quality is that if the manager's focus is on information flows, i.e. in ensuring that all necessary information exists and is delivered, then the amount of information may overwhelm the manager or at least take the focus off the people's ability to function autonomously in various situations. Instead, if the manager focus on the quality of the interaction, then the responsibility for maintaining information flows is transferred to the stakeholders that use the information and the manager's duty is to ensure that they are capable and motivated to do so. Sharing the responsibility saves the manager's efforts and enables focusing on ensuring that all necessary interactions work well.

5.2.2.2 Evaluate maturity of value information

The second identified pattern explains the unnecessary hurry as the main hindrance of collaboration. Sometimes efficient information management is understood as systematic removal of uncertainty (e.g. Koskela et al., 2002). The question that the ability to collaborate addresses is are all stakeholders ready to remove uncertainties at the same pace.

As described above, a considerable risk of misunderstanding exists if the users' statements are accounted as assured value information too early. The same effect is expected to occur in every interaction: draft designs should not be used as implementation designs, and cost estimates should not be used as bids. The same logic should be implemented in value information delivery: there should be a drafting phase before providing the actual information. However, whereas designers and contractors are professionals, users are not. Users should not be expected to know in detail what information to deliver in each phase. It is the professionals' obligation to facilitate the information delivery process.

Moreover, prompting users to give final statements too early decreases creativity. If prompted, they are biased to take the first suitable solution instead of the best one, just to avoid the pressure from construction professionals. This behaviour undermines trust because users begin to doubt whether the professionals share the same project goals, and if they want to build something for us or if they just want to build something to get paid.

These two aspects of collaboration, avoiding misunderstandings and supporting creativity, were studied in case 6. The importance of socio-emotional communication, creative atmosphere, and trust building were all recognised in case 5 already but more research was required to understand the

microactivities in the interactions, to understand what happens in projects in practice. The ontological basis of value information was re-determined by applying Gadamer's (2004) play ontology, a conception of reality, which consists of constant back-and-forth movement. To Gadamer, play is not equal to game or even player; rather, it underlines how he or she is played by the events and contexts, by the 'play'.

In this play, an individual user talked about an idea, opinion, or any other kind of expression. In the moment of expressing it, he or she could not be sure how others would react, whether they would express support or criticism. Nor can the one who reacts know what happens after his or her support or criticism. The supportive comment may result in some sort of mumbling expressing general acceptance or it may trigger another idea from a third person. The criticism may either cause a defensive reaction or help improve the original idea by revealing a weak point that can be removed. The point is that there is no single moment when a player can be sure that this is the value information that they are expected to deliver. The value information is an interpretation that may be concluded after a series of comments.

The first interpretation is probably not perfect. In a discussion there may arise ideas, comments, or opinions that are reconsidered or elaborated by other participants. Therefore, it is necessary have a series of events to be able to sense the back-and-forth movement of the opinions and considerations. The saturation of the back-and-forth movement is the observable aspect that reveals the maturity of the value information.

The second pattern of managing collaboration to enhance design quality is that designing according to immature value information increases the risk of design change requests. The maturity of the information can be observed in the series of user discussions by observing the back-and-forth movement of the opinions, comments, and ideas. The interpretation of both value information and its maturity is very content-dependent. Therefore, no general guidelines are offered. However, in the study of case 6 three kinds of situations were recognised regarding the evaluation of maturity of value information: silent acceptance, abandoning the idea, and inability to develop an idea. These are discussed in detail in paper V.

The patterns that answer the research questions are presented in Figure 11.

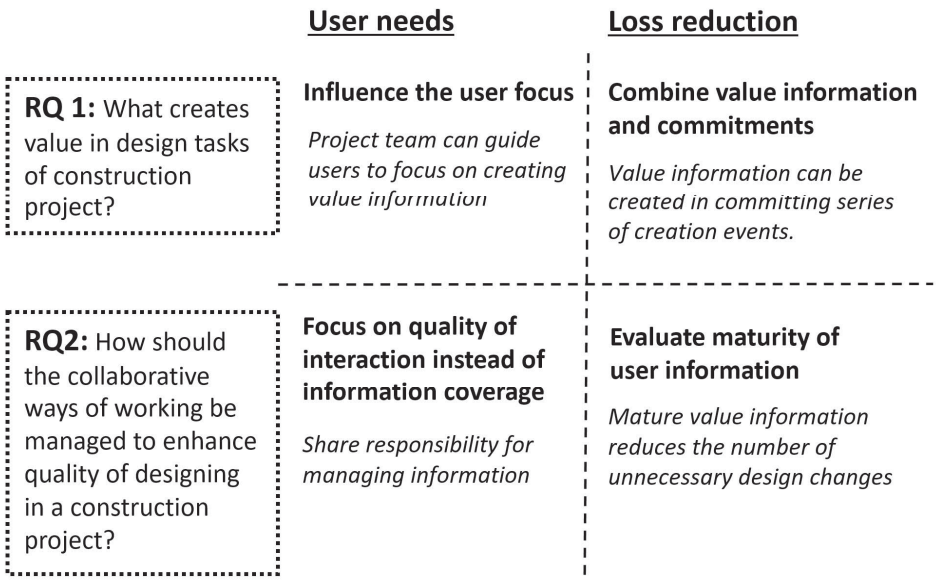

Figure 11. Summarised answers to the research questions.

5.3 Contribution of the research

The contribution to the existing body of knowledge of design management is presented as follows. First, the ontological positioning of value is discussed by comparing the conceptions formed in the principles 1-4 of the value creation logic in user-centric design to conceptions presented in existing literature. Second, the relationship between quality and value is discussed, and the arguments for principles 5-8 are presented. The third contribution is the managerial implications for creative dialogue. The discussion provides reasoning for principles 8-12 which are guidelines on setting focus in design meetings or similar events.

In the research of construction management and economics, the value is quite commonly understood as an entity that only exists in relationship with customer. However, the moment when the value begins to exist has not been clearly defined. For example in the TFV model (Koskela, 2000), value is described as being generated in design and production activities of a company based on information of customer needs. Even though this definition) builds a strong relationship between customer needs and value, it does not explain how and when designing creates value. In TVD, understanding of value is extracted into client's business case description and definition of allowable cost, and the value is delivered by developing a suitable solution as an outcome of the project (Zimina et al., 2012). Even though this definition) recognises that value is delivered by satisfying customer's needs, it implicitly assumes that value can also be somehow embedded into designs as

information on satisfaction of needs. Moreover, both definitions emphasise producer's role in value creation.

On the contrary, Grönroos and Voima (2013) presents clearer ontological positioning: value begins to exist when a customer uses a product. In that conception, value cannot be extracted from the customer's activity as information. Value information is merely anticipation before it is actualised in use. This dissertation has revealed how this ontological shift may be operationalised to serve customer objectives. To view a phenomenon as process, the dynamical nature of the phenomenon should be identified, i.e. stability should be destabilised (Langley 2007), and this is exactly what the ontological shift does. Information on satisfaction of needs is in dynamic state even after it is embedded into the designs, and the level of dynamism can be observed in the back-and-forth movement of the user comments. The first pattern of value creation provides a description of this phenomenon in practice by emphasising the impact of designing on the customer behaviour. The role of producers, designers, and implementers in value creation is merely to impact customer's ability to create value, and in the design phase that is done, in addition to designing, by helping the customer to focus on the relevant issues while creating value information.

Introducing the concept of value information enables explaining the connection between value, quality, and design. In the first pattern of value creation, the designing is described as a task where designer uses value information to create quality information. The ontological basis of quality information is slightly varied in comparison to value information: both exist in relationship with customer needs, but quality information is the producer's conception of user needs, and how to satisfy them, and therefore it can exist independently of customer. Following this determination, designs should be understood as quality information that is also in dynamic state until the product satisfies the needs. If value information changes during the project, quality information should be updated accordingly to avoid deficiencies.

The literature on design management has been unconfident with accommodating management actions' effects on design quality. For example, Lindahl (2004) notes that it is hard to verify whether good design has any impact on efficiency of customer organisation in office building projects. The concepts introduced in this dissertation, value information and quality information, shed light over this problem. The literature on quality engineering includes a number of useful rationales, for example, focusing on the voice of customer (Akao, 1990), avoiding loss by understanding the target of the customer (Taguchi, 1986), and creating purposeful feedback loops in quality information management (Juran and Godfrey, 1998; Deming, 1986).

This dissertation has elaborated and applied these rationales in design management. If the designing is understood as a task where designer uses value information to create quality information, the design manager should understand whether the value information is valid and used in the right manner when producing quality information. The first pattern of collaboration management provides a

practical example on how a design manager can understand both the validity of the information, and whether the designer will supposedly use it in the right manner.

In addition, the concepts of value information and quality information guide how the discussion should be focused in different kinds of interactions. Daft and Lengel (1986) suggest that the purpose of communication is to reduce both uncertainty and equivocality. Dividing interactions into value-driven and quality-driven interactions provides understanding of how to focus in each interaction. In value-driven interactions, stakeholders should focus on reducing uncertainty and equivocality of value information, while in quality-driven interactions stakeholders should focus on reducing uncertainty and equivocality of quality information. Yet it should be understood that uncertainties of quality information can be removed only after corresponding uncertainties have been removed from value information. Albeit a designer would sometimes like to hurry decisions, i.e. namely remove uncertainty from quality information, the ability to design decisions depends on customer's, i.e. user organisation's, ability to create value information and commit themselves to elaborate it. The second pattern of value creation provides an explanation on how this logic may be observed in risk realisation during the project.

This dissertation also provides understanding of how the creativeness and commitment are interlinked. Both require a series of meaningful experiences. The creativeness in this context is more than just getting an idea. It is, in addition, the ability to build on other people's ideas and commitment to elaborate those ideas so that they may be applied at the next stage of the process, in the interaction of the cycle (Figure 10). Prahalad and Ramaswamy (2004) suggest that value creation requires a series of interactions where information is exchanged between customer and producer. In construction projects, the customer is not a unanimous entity (Cherns and Bryant, 1984) and therefore the ability to build on other people's ideas is emphasised. Ability to build on other people's ideas enables focusing on well-being of the whole instead of one's own well-being, which is the valued impact of co-creation (Scharmer and Kaufer, 2013).

Yet, being creative is often understood as being able to find new and better ways of doing or expressing something. In construction projects, good designs are results of multidisciplinary effort, where numerous interlinked details are resolved in a way that provides satisfying results for users, if the contractor is able to implement them without deficiencies. To get this result, a creative atmosphere should be achieved in both value-driven and quality-driven interactions, and the commitment to elaborate should be maintained. The second pattern of quality management provides understanding for the atmosphere in design meeting and workshops from the customer perspective, how user tries to explain his or her point of view concerning the uncertain future with a level of anxiousness. This aspect connects the concept of design management to the process thinking literature by illustrating how an outcome is 'becoming' instead of 'being' (Chia, 2013; van der Hoorn & Whitty, 2015). Moreover, destabilising source of user information takes the design process off the mechanistic worldview into the constantly changing socially constructed one. This novel understanding enhances

the design manager's ability to focus on customer needs in an appropriate manner in every phase of the project.

5.4 Limitations

As in the credibility of research in general, in this dissertation, too, applies the rule: "All you can do is reduce the possibility of getting the answer wrong" (Saunders et al., 2009). That means paying attention to reliability and validity. Reliability refers to the extent to which the research procedures will yield consistent findings, and validity refers to whether the findings are really what they appear to be (Saunders et al., 2009). In the dissertation, several factors were recognised that may influence reliability and validity.

The first factor is the fact that in all the cases except the case 1 the design manager was the same person, the author, and in all the cases the property owner was University Properties of Finland Ltd. This has certainly influenced the management procedures and represents an interference threat to internal validity (Yin, 2009). However, the design manager or project manager alone is not the whole of the management, and the owner is represented by several persons. In addition, the management procedures were the subject of the research, and the procedures have been purposely altered to enhance the stakeholders' ability to collaborate. Therefore, the observations may be judged reliable and valid because the user group was different in each case and the identified patterns still correspond with the observations concerning the collaborative design management's effect on value-in-use in every case.

Another point worth considering is the similarities among the users. All of them are either university staff or students. This may form a bias which should be investigated in further studies. However, there have been more than one hundred user participants in the participatory design workshops, a sample with considerable size of different people with varying preferences. Therefore, results concerning user needs recognition procedures may be considered as reliable, although a threat on external validity exists (Yin, 2009) in a sample biased to higher education. People with higher education may be more analytical but almost all users were inexperienced in construction projects. And even though the sample comprises assumably smart people, they too had terminology problems in communicating their thoughts, making them more similar to the average people.

Third point to assess is that all cases are relatively small renovation projects, where the user organisation has been available since the beginning of the project. This probably narrows the external validity of this dissertation. Ensuring generalisability to projects with bigger scope or project where the users are only engaged in later phases would require further research. However, there is a considerable number of projects where the users are available from the beginning of the project and

where the design team includes only one member from each discipline, and the research may be considered as externally valid within these frames.

In order to improve reliability, each paper is written by several authors who have come to the same conclusion when analysing the same data. Yet the research design includes pattern recognition from first four cases and repetition in case 5 and, to some extent, also in case 6. The patterns are examined by several research teams and reproduced purposely. This gives the confidence to claim that the results are reliable.

To make a final point, in addition to the case-related points, there are also cultural matters. All cases were implemented in Finland, an open society where people typically trust each other. It would be interesting to research how widely these findings apply when cultural aspects are varied. However, the point of this dissertation has been to present that design quality can be improved by using collaborative ways of working, at least in favourable cultural conditions. Therefore, the author wishes that the findings of this dissertation will encourage all cultures to build trust among people as well as to develop collaborative ways of working and design quality in construction projects.

5.5 Suggestions for further research

Based on the results, the dissertation makes two suggestions for further research. The first suggestion is to extend the studies to projects where the users are not engaged in the beginning of the conceptual design. Projects are often initiated by real-estate developers, and users, the tenants, are engaged in rather late phases. It would be interesting to study what kind of patterns can be identified regarding value information creation, and how the emergent user-centric value creation logic could be applied to reduce the developer's risk.

The second suggestion is to study how the managerial implications can be implemented when the project scope is scaled up. The implication of observing the quality of key interactions is of great interest because it suggests how the quality of the design can be managed with less effort than pursuing to ensure the coverage of all information. According to the experiences that stakeholders have shared during the study of this dissertation, the coverage of the information flows is a weak point of design management. Its management is experienced as an overwhelming task because of the sheer mass of information. However, it is not self-evident that the management procedures suggested in this dissertation will work in large projects even though, based on the evidence of this study, they assumably do. In larger projects, communication procedures and information flows may be more complex, and therefore more research is needed.

The topics above only represent the first ideas for further studies. The author wishes that this dissertation will inspire other researchers who will find more research topics concerning user-centric design management and value creation.

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ORIGINAL PAPERS

I

STIRRING THE CONSTRUCTION PROJECT MANAGEMENT WITH CO-CREATION AND CONTINUOUS IMPROVEMENT

by

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Stirring the construction project management with co-creation and continuous improvement

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Abstract

Gathering information that is capable to explain customers' needs is usually seen as a quite straightforward part of the traditional construction process: a customer should be able to tell all relevant needs in the first stage so that a building could be designed and built according to the gained information. But the process is lacking of service abilities if a customer wants to modify the given information due to a change in circumstances, albeit such a change is easily caused due turbulent economic situations and long spans in real-estate development projects. Hence the customer perspective regarding the construction management (CM) process should be accommodated better. In this paper, the case studies of the four premises improvement projects are reported upon, where the CM process was altered to include and apply the concepts of continuous improvement and co-creation. The process documentation covered the impacts of the case project on the usability of the premises, the indoor climate conditions (carbon dioxide and temperature) metering, the time lapse cameras and the on-line user feedback system. The documentation consists of the minutes of the meetings, the financial reporting and the time tables. Both the processes and the results of the projects are analysed. Based on the key findings, some suggestions are put forth upon how to improve the CM process to better serve customer interests and quality improvement in the future.

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Keywords: Co-creation; construction management; continuous improvement; customer relations management; quality management

1. Introduction

Significant potential in service innovations is considered to exist in various industries, but in many cases service innovations are understood as improvements in customer services. In practice, this may lead to situations where the

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service perspective has been adopted at the strategic level but the traditional goods perspective is still dominant at the manufacturing level (Grönroos & Helle, 2010).

In the case of University Properties of Finland (UPF) Ltd, the need of general improvement in facility management (FM) services business was recognised around 2010. For this reason, UPF launched a study concerning the implementation of evidence based design and co-creation, based on the assumption that new practices should be developed for improving all stages in construction projects – from concept development to the handover and use of premises. Moreover, a comprehensive investigation was seen essential to reveal a gap between the assumption about premises ideally serving users and the actual uses of premises. The management of UPF perceived this gap to be a bridge that needs to be built as part of a transition towards the service dominant business logic in FM services business. The need to investigate evidence based design practices was framed by studying the actual performance and outputs via the three key aspects as follows:

1. *What is the actual improvement in the utilisation of the premises when a retrofit project has been carried out?* It is quite common that retrofit projects are carried out with the determined objectives of improvement. Very rarely, the actualisation of the improvement and the real current use of the premises is being later confirmed against the target designs, such as: "Do people use the premises in the ways that the architect had imagined in the design phase?", "Has the utilisation rate improved?" and "How has the mood of working changed?"
2. *How should new practices be implemented?* Based on the prior experience within the organization, it was assumed that every new practice causes resistance that disturbs design work, lowers down the features of new premises and slows down occupation. Co-creation practices (Prahalad & Ramaswamy, 2004) were seen as a promising way to confront these problems.
3. *What tools could be used for marketing new ideas*. The idea was to provide information about new solutions in premises from users to users. In this way, information would be in such formats that the users of premises could understand when planning their next facility upgrading projects. Supposedly, this would also ease communication between architects, a PM team and users.

Even if the idea of combining evidence based design and co-creation seemed promising, no relevant method could be identified for measuring the impacts of the adoption of these two value creating practices in actual projects. However, there was a lot of data that was gathered with many kinds of equipment for the evidence based design research. Thus, a novel method was developed to gather data that enhances understanding of the ability of users to benefit from premises.

The focus of this study is on the ability of users to benefit from premises. This was seen as a key to understand real estate development as an activity where products and services are developed, instead of a business where assets are managed. The objectives of PM processes were set to serve the usability of outcomes, i.e. impacts on users are considered before production capability, schedule and budget. The application of co-creation practices is seen as a significant way towards the realisation of this shift. As co-creation took place mainly in concept development phases, it is now assumed that also the other parts of the PM process can be improved in a radical manner.

In the same vein, the PM process was re-organized to utilise practices in continuous improvement (Deming, 1986). Tests of the re-organized process were called process demonstrations. The process demonstrations were implemented as part of four small scale retrofit projects, all constituted by UPF. Each project encompassed a specific application of improved processes ranging between a new way to explore customer needs and a completely enhanced process where the organisation as a whole was re-arranged to apply continuous improvement's work order. The method of action research was applied.

The contribution of this study is a system enabling users to have improved capability to understand the implications of new solutions, i.e. performance is explained with the help of the models and data. Moreover, it seems that this designed and studied approach also improves end users' commitment, by better process understanding.

2. Theoretical background

Economics is seen as a valid viewpoint when discussing added value and total value. In economics, it is supposed that every stakeholder aims to maximise utility and, thus, value is understood as someone's ability to utilise a product or a service. It should be noted that this is not the same thing as market price. The way how market defines prices is explained in economics by equilibrium price, i.e. price where the quantity demanded meets the quantity supplied (e.g. Begg et al., 2008). Utility someone gets from a product probably exceeds market price; why else such a transaction would happen. Moreover, the amount of this excess is not tied to the monetary value of market price from individuals' point of view and why should it. Different persons in different situations may of course gain enormously different amount of utility from a similar product. Based on this reasoning, two questions are posed:

- Whose utility should be measured?
- How to measure value via utilisation, if it cannot be measured via market price?

As the concept of value has rather a subjective nature, Rooke et. al. (2010) suggest that instead of objectivity the concept of intersubjectivity should be used, in which "objectivity is socially established from the stream of our perceptions". Thus, it has been shown that both observing the utilisation of premises by masses and surveying the opinion of masses are suitable ways for researching value.

Utilisation of premises can be understood through the users' functions – tasks that premises are for. The mechanism, how the features of premises affect to users' functions, can be understood through Kano's (1984) categorisation. There are three main categories of products features: must-be, one-dimensional and attractive. All of them play their own part in the value generation of products and each of them has its own characteristic behaviour in relation to customer satisfaction (Kano et al., 1984; Berger et al., 1993).

Customer satisfaction can be used as a vital meter when researching the value of products if it is connected to the recommendation behaviour of customers (Reichheld, 2006; Kähkönen & Savolainen, 2013). Thus the surveying of customer satisfaction is important, but it is also important to observe the actual behaviour of users. Indeed, Zeisel (2006) emphasises that "the better information designers have about how the people they design for behave in physical settings and how those people relate to or exclude other people, the better they can control the behavioural side effects of the design decisions they make."

Pursuing the value maximisation may be also seen as a matter of pursuing for quality, at least if the Juran's dual definition, which is generally accepted, is used, i.e. quality means (i) a product's features that meet customer needs and (ii) freedom from deficiencies (Godfrey & Juran, 1998). The selected combination of features may be seen as a plan to deliver value and the rate of "freedom from deficiencies" may be seen as success rates in the actualisation of plans.

Delivering quality is not a task that is inevitably accomplished. Over the past decades, various attempts have resulted in several systematic methods that make value creation more understandable. The best known methods may be the Quality Function Deployment (Akao, 1990) and Taguchi methods (Taguchi, 1986). Therein, product development is divided into three phases that are shown in Table 1.

Table 1. Three phases in product development and building project development.

Quality Function Deployment (QFD) (Akao, 1990)	Taguchi methods (Taguchi, 1986)	Phase in building project development (applying Smith 1998)
Developing the quality plan and the quality design	System design	Feasibility studies
Detailed design and preproduction (Subsystem deployment)	Parameter design	Design
Process deployment	Tolerance design	Tendering process/ Contract/ Procurement
Production/Implementation		

The common feature in the QFD method, the Taguchi method and the building project phases is the determination of ways of client value generation in the first phase, followed by the design phase. This task can also be seen as understanding the functionality from the clients' point of view. Thereafter, the concepts start to differ from each other. With the QFD and Taguchi methods, the next phase is to determine parameters to provide functionality or technical characteristics to get products work in ways that clients want.

In building projects, the third phase involves the tendering process that results in contractor selection. In reality, this kind of phasing can lead to a situation where the design task is seen as a subtask for the procurement task, i.e. the most important objective of the design phase is to produce technical attachments for requests-of-tender. In such situations, the focus is shifting away from the functionality of products toward the ability to produce them. Moreover, this phenomenon is intensified when the process goes on. Feedback from design work comes from a contractor which mainly evaluates the easiness to implement and gives improvement suggestions based on cost efficiency.

It is herein perceived that it is urgent to avoid such shifts of focus and instead to re-connect the voice of customer to design activities. In the process demonstrations of this study, the re-connection was established by the two distinct concepts, i.e. co-creation and continuous improvement. Co-creation is a new way of viewing customer relationships. In the traditional thinking, value is created into products by companies and customers must either be satisfied with what they get or decide not to buy the products in question. In the co-creative working, the idea is to exploit the client knowhow of utilisation of products by developing ways of interaction between a firm and its clients. There are four cornerstones that are used in understanding the role of interaction: dialogue, access, risk assessment and transparency (often referred to as DART) (Prahalad & Ramaswamy, 2004). The concept of continuous improvement is one of the fundaments in delivering quality (Deming, 1986; Godfrey & Juran, 1998). The concept may be applied by using Shewhard's (1939) cycle: Plan - Do - Check – Act (PDCA), recommended by Deming (1986).

3. Organising process demonstrations

The process demonstrations were carried out as part of the four small scale campus retrofit projects in 2014. The scope of each project was to improve either the single space or a couple of the connected spaces that formed the area of around 300 – 400 square meters. The brief descriptions of Projects 1-4 are compiled in Table 2.

Table 2: Process demonstration projects of University Properties of Finland (UPF) Ltd in 2014. (Key: The feasibility study phase was replaced with the co-creation phase. In some projects, the PM process was improved by using the Plan – Do – Check – Act inspired phasing in the schedule of the meetings. In Projects 2-4, the action researcher was positioned as the design coordinator or the project manager in the improved phases, marked with the bolded text.

Project/phase	Co-creation	Detailed design	Procurement	Building phase
Project 1: Auditorium retrofit to multi-purpose learning environment	Half day workshop to discuss how premises are used	Traditional project management	Traditional project management	Focus on handover
Project 2: Language learning environment	**3-day charrette workshop with rough cost estimating**	Traditional project management	Traditional project management	Focus on handover
Project 3: Learning and presentation environment for music students	**5-day charrette workshop with rough cost estimating**	**PDCA inspired meeting phasing**	Traditional project management	Focus on handover
Project 4: Modern multi-purpose learning environments	**Two half-day workshops for each retrofit area with rough cost estimating**	**PDCA inspired meeting phasing**	**Procurement by negotiation (with PDCA inspired phasing)**	**Focus on the easy beginning of the utilising of premises**

The co-creation was applied by organizing the various workshops in the beginning of each project. The role of the co-creation varied from the few hours check-up meeting to the charrette, which is intensely focused, multi-day session that uses a collaborative approach in order to create realistic and achievable designs that work (Lindsey, 2009). In every process demonstration, the focus was set on the collaborative value creation with the users during the early stages. This focus shift deliberately separated the cost issues away from the value creation dialogues. The cost calculations were made and dealt with after the value creation dialogue.

The detailed design phase was implemented either by the traditional ways or by using the improved process that was planned to use PDCA phasing (Fig. 1). The traditional PM was seen to be a process where the project manager gives the designing task in the first design meeting and follows the actualisation rates in the following meetings. The main difference is between only one (design) meeting as part of the traditional PM process and several meeting types with the determined roles for interaction as part of the improved process.

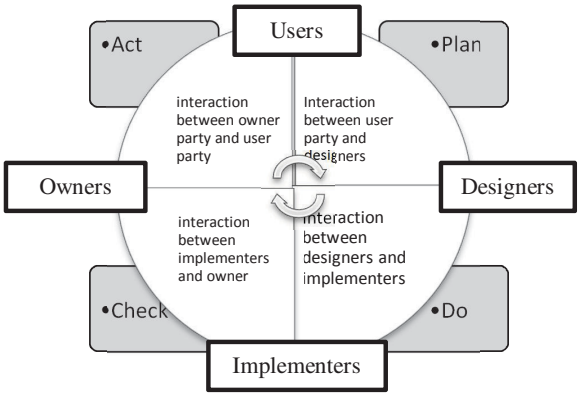

Fig. 1. Plan – Do – Check – Act (PDCA) cycle applied to the interaction phasing in building projects.

The purpose of this interaction division was to determine the two aspects for each meeting as follows:

- What is the perspective of this this meeting? Are we discussing about the planning of the premises, the implementation of designs, the budget and the schedule or the corrective actions, or all of them?
- Who should assume the primary roles during the discussion in this meeting? Who should be present?

The Plan interaction was a dialogue where the main questions were "How are the premises used?" and "How should the premises perform?" The Do interaction was a dialogue between the designers and the implementers where the main questions were "How should the required performance be delivered?" and "What is the most cost effective way to implement it?" The Check interaction was a dialogue between the implementers and the owner where the main questions were "Does the value stem with the cost?" and "Can the project of this scope be financed?" The Act interaction was a dialogue between the owner and the users where the main question was "How should the project be modified, if the scope suggested is not affordable?" In this way, the downshifting of the project was done by those who have to live with the decisions made.

4. Method to measure improvement in utilisation

The idea behind evidence based design is that designers have a database consisting of proven design solutions. The assessment of performance of different design solutions is carried out via observations on the real use of premises as the source for proven solutions. Such a fairly detailed functional evaluation could not be conducted based only on the surveying of customer satisfaction.

In this study, the pre-occupancy and post-occupancy evaluations were conducted in order to estimate the impact of the designs on the environmental behaviour and usability of the spaces. The observational data were collected through the indoor climate conditions (carbon dioxide and temperature) metering, the time-lapse recordings and the on-line satisfaction survey. The idea is to get a comprehensive view on the usability of the observed space.

The indoor climate conditions were inspected to make sure that that there was no obvious but invisible reasons that would have negative effects to the usability. The role of the time-lapse observations was to observe the predicted use of the space. For the quantification, the time-lapse recordings were observed and systematically coded with the pre-coded checklists of the use with the two main categories "work" and "leisure" and the categories of "characteristics of participants" (alone, in pairs or in groups) together with the time frames of the uses. The observations provided the researchers with the replies to the following questions "What kinds of actions happen?", "How is the space used?" and "How do people interact in and together at the space?"

The role of the on-line satisfaction survey was to facilitate the channel for the users to express something unexpected information. The data was collected by using the QR-code posters. The users could give the feedback with their smartphones by simply snapping the link from the QR-code poster, voting plus (+) or minus (–) and possibly giving the explanatory text feedback. The votes were given for the question "Would you recommend this space for studying?"

The fourth data type of this study was the project documentation. The data consist of the minutes of the meetings, the design drawings, the financial data and the schedules. The project data was gathered from many locations, such as the network drives, the project databanks and the cloud drive. The cloud service was selected for the data storage to enable the access to the data for the researchers also in future research projects. The data covers the demo projects that UPF has carried out in 2012-2014. This data can be re-utilised in future research (mainly for the examination of learning environments), the planning of new projects, the development of projects, etc.

5. Discussion

In the paper, only the preliminary findings are reported upon. However, the improved process has already resulted in some promising findings as follows. The co-creation phase has improved the mutual trust among the parties of the project. The cost estimates in the end of co-creation phases did help to begin the prioritization dialogue between the users and the owners. The prioritization enabled the designers and the implementers to come up with the suggestions for the cost savings. Without the prioritization, the cost saving suggestions would have been probably more or less blind vis-à-vis the users' ability to utilise premises. Thus, the continuous improvement had been enabled.

One of the key observations addressed the development of the end users' understanding. The knowledge about how they may and will use the premises actually increased a lot during the project. In principle, premises improvement is only a part of a greater project and when the focus is set on this scale, it becomes much easier to understand how users view a situation, i.e. premises improvement projects should provide stakeholders with data on future premises for business improvement projects. Thus, it is not relevant to think that all information for a design process would be available at once in the beginning of a project.

Probably the most significant finding was the observation on the progress in the users' understanding in the beginning of the project. In principle, users cannot have ready-to-use consensus in the beginning of a project so that this consensus could be used as initial information for design work. Consensus may be reached by a well facilitated co-creation workshop. Moreover, the meaning of the workshop is to guarantee equal voice for each stakeholder so that true mutual understanding is achieved. On the contrary, if a workshop is not deliberately pursued, the strongest voice takes over others and obviously a bias situation is prevailing between stakeholders.

In many projects, the finding of true mutual understanding between stakeholders may be an extremely complex task because many stakeholders may belong both to a customer's side and a producer's side around a table. Moreover, stakeholders in both sides may be arranged by hierarchies where some stakeholders have more power than others. If a project organisation is satisfied with a situation where the executives of both sides find mutual understanding and sign an agreement, then executives have been heard. But there are no means to guarantee that premises will be designed by using best knowhow about utilisation. Mutual understanding must be found between different user perspectives before an agreement between a customer and a producer is signed. Multiple relevant user perspectives may come from the different functions of all departments or from different tasks across all hierarchy levels within organisations.

All this communication between users may appear as irrelevant disinformation from the perspective of building and design organisations. Discussions take time and sometimes have only a small effect on final designs. Furthermore, discussions can complicate PM as power over design decisions is shifted from a design organisation to a user organisation. For some managers, it may be difficult to see the pros of new practices when the cons are so imminent and, thus, they resist such changes. In order to overcome such barriers, the benefits of enhancing customer experience should be put forth at operational levels.

6. Conclusion

Even the preliminary findings of this study highlight a need for a democratic method to provide all stakeholders with possibilities to be heard from every angle. Furthermore, it is of importance that different perspectives are brought on a joint table so that that each project partner can understand pros and cons for certain approvals and/or particular disregards. Within a process, each different view is to be treated equally, i.e. for reaching a balance of different ways to utilise premises.

It is posited that the balance of premises' utilisation is a novel perspective in the area of feasibility studies. This part of feasibility studies is herein called a Balanced Concept of Utilisation (BCU). The BCU is an agreement where multiple user parties recognise how utility is gained from premises by different tasks and functions, and how these tasks and functions are prioritised.

The BCU enables the gaining of benefits from the process enhanced with the continuous improvement phasing. When a BCU is formed and approved, it is easier for designers to understand users' perspective as an entity. This produces the perspective of usability alongside with the perspective of ability to build, which is of particular importance when interaction between designers and implementers begins. A BCU is a document that should be reviewed along cost estimates and schedules. It is important to understand how the ability to utilise is affected if costs need to be cut and what an effect is on a balance between different functions. Such an analysis provides decision makers with relevant information concerning the next phases of projects at hand.

The utilisation of BCUs in PM opens up a plenty of topics for further research in terms of key questions like "How to determine technical parameters for a product by utilising a BCU?", "How to design utility metering based on a BCU and how to combine that information with evidence based design?", "How should a BCU influence a supervision task in a building phase?", "How to design tolerances by utilising a BCU?" and "How should additional information gained during a project influence to a BCU?"

All these topics are related to the dual definition of quality as a product's features that meet customer needs and freedom from deficiencies (Godfrey & Juran, 1998). When a BCU determines the functions and tasks that users want to accomplish, the quality of premises should be determined by how well users may accomplish each task and function. All other measures such as customer satisfaction or project delivery on time should be seen as sub-targets of this main target. It is argued that all other ways leads to partial optimisation. This means that the construction industry should review the responsibilities of each party and investigate the new forms of co-operation, because it is perceived to be unlikely that a contractor, a consultant, a designer or even a real estate owner single-handedly shifts its focus on the suggested scale.

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II

CASE STUDY: DEVELOPING CAMPUS SPACES THROUGH CO-CREATION

by

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Case Study: Developing Campus Spaces Through Co-Creation

Higher education institutions are designed to support their core processes − learning, teaching, research and societal impact. In order for university facilities to support these activities, it is crucial to determine together with the users what these activities are and how they are supposed to be developed in the future. This article examines the relationship between user needs and the service level in construction projects through a case study where a university cafeteria was renovated using a participatory design method called charrette. The aim of this case study was to study the effects of collaborative ways of working when applied to a space retrofit project, and how the co-created ideas are actualized during the project. Based on video observation, project document analysis, and survey questionnaires this research shows that participatory design duly provides a positive impact on the resulting premises, even though every part of the project may not be successful. However, the use of participatory design during the concept design phase does not necessarily guarantee success. The accomplishments can be undone in the later phases of the project if collaboration is not extended through the entire project. Further, the findings of this case study revealed a framework of user needs that can be used in design management in order to enhance the user perspective.

Keywords: co-creation; collaborative design; learning space; value-in-use; campus retrofit; charrette

Introduction

The transition from transaction-oriented management to relationship-oriented management (Grönroos, 1996) and the adoption of service-dominant logic (Vargo & Lusch, 2004) have been seen as the major components of competitiveness in modern service economies. Both of these concepts emphasize the value production of total service offerings and encourage a focus on firms' capacity to improve customers' performance instead of the product itself.

However, in the field of built environment, it is not unusual that the focus is very much on the property and the product instead of on the effect on user operations. This may lead to a situation of sub-optimization where the building cost is optimized while the increase in the operating costs leads to increasing total cost. For example, Aalto & Saari (2008) have reported a case study involving meal logistics in a sheltered house for elderly people where the lowest construction cost would have led to 17% higher total costs than the optimal solution.

Despite the potential savings in total cost, in some cases the importance of user collaboration is neglected. Jensen (2009) has noted that facilities managers, who are responsible for service for the users of their facilities and who should have a comprehensive picture of the cost effects, are not treated as equal dialogue partners in the design process. It is conceivable that the customer value of building projects could be significantly increased if the user perspective were treated equally in the design and construction processes. The competitive advantages of this kind of value co-creation have been reported in many other industries (Prahalad & Ramaswamy, 2004), so it can be predicted that benefits can be found when it is applied in building projects. However, it seems that the evidence of these benefits is difficult to verify, even though there has been plenty of time and effort spent trying. Co-creation has been applied in architectural design since at least the 1970s in the form of participatory design (Lindahl, 2004).

The effects of cooperation and collaboration in design processes have been investigated in many cross-sectional studies. There is a great deal of research that focuses on only one particular phase of projects, such as the design phase (Hansen, 2008) or the handover phase (Piroozfar, Adeyeye, Rosenkind, & Winstanley, 2013). In addition, in many cases, interactions in the processes are studied separately. The research seems to concentrate on the customer relationship (e.g., Siva & London, 2011)

or the relationship between designers and project team members (e.g., Mäki, 2015). And yet, there are studies concerning how projects meet their objectives (e.g., Stringer, Dunne, & Boussabaine, 2012). But, as the example of the meal logistics case (Aalto & Saari, 2008) reveals, narrow inspection of benefits may lead to malicious sub-optimization of cost. Therefore, we suggest that it is important to report longitudinal case studies of building projects that may present a more holistic assessment of benefits gained from collaboration.

In this study, a lunch restaurant at the university campus was renovated and converted into a new learning space using a participatory design method called charrette. Learning spaces are considered to be complex webs of different factors – physical, social, virtual, cultural, temporal, and psychological (e.g., UNESCO, 2012). As a consequence, in recent years, the concept of learning spaces/environments has been approached in more holistic way in order to describe the totality of the factors influencing the learning situation (e.g., Barrett, Zhang, Davies, & Barrett, 2015; Barrett, Zhang, Moffat, & Kobbacy, 2013; UNESCO, 2012). The aim of this case study was to construct a holistic understanding of the benefits of collaborative working in relation to quality assurance of the final product by examining the participatory design process, observing space usage, and surveying user-experiences.

The project was studied from the concept design phase until the premises had been used for six months. This created the possibility to better understand the effects of co-creation and collaborative design when applied to a space retrofit project as well as how the co-created concept of utilization has been actualized in the project. The research team observed and participated in the design sessions and meetings during the concept design and technical design phases. The construction phase was documented by official minutes of site meetings, and the beginning of use was documented by two separate

observation periods and questionnaire surveys. The research questions are:

(1) How are the requirements for a space created through a co-creation process?

(2) How does the final product meet the users' needs that were conceptualized during the charrette?

(3) How did the service process answer the requirements of the end user?

Developing Service Process as a Part of the Project Management Process

Managing construction processes efficiently is one thing, and developing purposeful service processes to complement value creation is another. Both require cooperation and communication, but the focus is different. The differentiation of the focus may be examined through the concept of value.

In economics, it is supposed that every stakeholder aims to maximize utility, and thus value is understood as someone's ability to utilize a product or service. What distinguishes a service from a product is that a service is something consumed immediately when it is used (Begg, Fischer, & Dornbusch, 2008). However, in the construction industry, it is not always clear whether the industry is dealing with services or products. New or renovated spaces are obviously products, but the construction industry is sometimes referred to as construction services. A reinforced concrete foundation cannot be consumed while it is being cast, but the project team produces an abundance of information that the customer may utilize during the design and construction process. In sum, one can recognize the characteristics of a service.

Vargo and Lusch (2004) blur the distinction between a product and a service. In their service-dominant logic concept, they argue that the basic purpose of both services and products is to transfer skills and competencies from one person or group to another. Products are appliances that provide service to the customer; additionally, if the service is to be delivered, the user must not only be able to buy the product but must also learn

how to use it. Therefore, they suggest that the customer is always a co-producer of a product. Service-dominant logic (Vargo & Lusch, 2004) is based on the paradigm of relationship marketing (Grönroos, 1994), which emphasizes that creating and maintaining the relationship with the customer is far better marketing than concentrating on sales and transactions. In the relationship marketing vision, most employees work as "part-time marketers" because they are responsible for direct customer contacts or value delivery (Grönroos, 1994).

Prahalad & Ramaswamy (2004) used the term co-creation in reference to such business activity that combines co-produced value and enhanced service. The concept of co-creation emphasizes the role of co-creation experiences that are delivered using partner networks and multiple channels of communication. The aspect of transparency also has a dominant role as the customer should become as equal a partner as possible in value creation (Prahalad & Ramaswamy, 2004.) In co-creation processes, the service provider party takes an active role and engages the customer in order to find opportunities to co-create value-in-use (Grönroos & Voima, 2013).

The concept of co-creation has been used in construction for decades in the form of participatory design. However, the clear, positive impact of co-creation in building design is not self-evident. Lindahl (2004) noted that, albeit that user participation has been used at least since the 1970s to create more user-friendly work spaces, its effects on organizational performance are not clear. It is important to consider whether user-centric architectural design is just comfortable or whether it is also beneficial in the economic sense.

In essence, co-creation or participatory design (PD) is just another conceptualization of the benefits of collaborative ways of working. There are also other concepts, such as concurrent engineering (CE), the purpose of which is to combat the

inefficiency caused by the fragmentation of the construction industry (Kamara, Anumba, & Evbuomwan, 2001; Love & Gunasekaran, 1997). Further, integrated design (ID) is widely used to describe collaborative design work using building information models (BIM) (Rekola, Kojima, & Mäkeläinen, 2010). It seems that all three of these terms are used to describe how collaboration can bring advantages to design practices. So, in that sense, it is understandable that they all are seen as synonyms of collaborative design. For example, collaborative design is sometimes used to describe working with shared design tools like BIM (Plume & Mitchell, 2007; Oh, Lee, Hong, & Jeong, 2015) and sometimes as a synonym for participatory design, where the role of different stakeholders, especially users, is embraced (Elf, Fröst, Lindahl, & Wijk, 2015).

Despite the similarities, some differences can be recognized in the objectives of the concepts. As described above, participatory design aims to provide construction professionals with a comprehensive picture of user utilization so they can better understand their mission. Thus, the primary objective of PD could be seen as maximizing value-in-use. That assumption is also supported by Kpamma, Adjei-Kumi, Ayarkwa, and Adinyira (2016).

By contrast, concurrent engineering is targeted more towards cost efficiency. Love and Gunasekaran (1997) suggested that the mechanism that improves performance in CE is the elimination of non-value-adding activities, with the help of multidisciplinary team. Kamara, Anumba, & Evbuomwan (2001) described CE as practices of cohesive design processes, where cooperation between designers and manufacturers is enhanced, which pursue higher customer satisfaction by reducing costs and improving quality. Even though improving quality is stated as a partial target of CE, that is not the same as improving value. The definition of quality from Juran and Godfrey (1998) may be used to clarify the difference between these two concepts. They

wrote that quality may have many meanings, but only two of them are of critical importance. One is that quality means those features of a product which meet customers' needs, and the other is freedom from deficiencies. In that sense, it can be seen that PD pursues improved quality via a better understanding of customer needs. It can be seen as a process for selecting features for the list of requirements because extra effort is invested in creative dialogue with customers. In CE, extra effort is put into the collaboration between designers and manufacturers, so the quality-improving activity is more like finding suitable ways to provide features on the fixed list of requirements. This can be understood as the task of finding cost-efficient ways to provide some fixed functionality with minimum deficiencies, whereas PD tries to discover new functionalities.

Integrated design (ID) as a term has a slightly different connotation than participatory design (PD) or concurrent engineering (CE). Both PD and CE give the impression that designers are collaborating with other stakeholders, but ID gives the impression that the designers are in intense collaboration with one another. It is understandable that the appearance of ICT tools like BIM have required new working procedures; however, it seems that on some occasions (Sebastian, 2010; Rekola, Kojima, & Mäkeläinen, 2010) the term ID is used primary because of BIM and only secondarily because of integration. However, deepening collaboration between designers could have deeper implications than merely working with the same information model and finding clashes between ventilation ducts and pipelines. That kind of checking activity could be seen more as a cooperative act than as true collaboration. Kvan (2000) suggested that, in collaborative design, the relationship is more durable and pervasive than cooperation. In collaboration, individual experts

should have a higher sense of working together – of a common mission with common problems to solve.

However, whether the design team is using BIM for clash checks or truly working as a collaborative team, ID is supposed to improve design quality. Emmitt and Ruikar (2013) noted that design quality is a subjective value and not easy to measure objectively. If both natures of quality are examined, it can be seen that although the selection of features may be very subjective, freedom from deficiencies is much more objective. When considering the distinctions between PD, CE, and ID, it can be observed that selecting the features that fulfil customers' needs is primarily related to PD. CE, on the other hand, is dedicated to reducing cost without causing deficiencies. To avoid the overlap between these concepts, ID should be seen as a supplement to the other two. Therefore, it should have an objective that is different from but still related to the objectives of PD and CE. To elaborate this, it is useful to examine the output of ID – designs in the form of either drawings or BIM. The output can be recognized as mere information. Any tangible product, such as a drawing, can be seen as a mere container of the actual product – the information.

Rooke, Sapountzis, Koskela, Codinhoto, and Kagioglou (2010) have developed a concept of lean knowledge management that can be applied to the examination of the management aspect of design. They defined lean knowledge management as getting the right information in the right form to the right people at the right time. Getting everything right can be seen as closely related to avoiding deficiencies. The managerial aspects of "right time" and "right people" are obvious, but the characteristics of "right information" and "right form" could be analyzed a bit further. If the mission of ID is seen as "building information models without deficiencies," the design team must first of all understand the information they are receiving Then, they must check whether the

technical solutions they are suggesting actually meet the needs of customers and, in addition, actually provide such information to customers as can be useful in decision-making. These tasks necessitate constant dialogue with customers. So, even though the actual job of the designer may be to build the information model, designers must also work as "part-time marketers" (Grönroos, 1994) of their disciplines. In addition, they have to work as part-time marketers in their dealings with construction companies to make sure that the information is flawless with respect to buildability and cost optimization. Further, the information must be complete and in an understandable form.

Therefore, we suggest that the objective of ID should be understood as accuracy of the information in relation to 1) how solutions meet customer needs and 2) how total costs are optimized. Figure 1 illustrates how PD, CE, and ID complement one another. We suggest that an understanding the relations between and different objectives of these three facilitates their use as managerial devices.

[Figure 1 near here]

Space Solutions for a New Learning Paradigm

Higher education institutions are designed to support the core processes of higher education – learning, teaching, research, and societal impact. In order for university facilities to support these activities, they should be seen as service platforms offering various services to their users. Therefore, it is crucial to determine, together with the users, the nature of these activities today, how they are expected to develop in the future, and how spatial solutions can support them.

Recent understanding of the learning process and the effects of economic and societal forces on it as well as the proliferation of ICT are forcing educational institutions to develop their culture, pedagogy, and, increasingly, the physical

surroundings of learning. Universities and other institutions of higher learning play an important role in building knowledge-based economies (Salem, 2014) that are based on the production, distribution, application, and use of knowledge (OECD, 1995). Knowledge is characterized as being interdisciplinary and as being generated by groups that are composed to solve designated problems (Gilbert, 2005). Universities are called upon to offer entirely new ways of understanding the super-complex world (Barnett, 2000) and to encourage students to partake in lifelong learning (Prokou, 2008). This requires the integration of theoretical and practical knowledge, development of skills and competencies, and the ability of individuals to reflect on their own practice (Tynjälä, 1999).

For educational organizations, this means combining informal and formal learning, learning across time and locations, and the use of various pedagogies and multiple devices (Sharples et al., 2013; Wong & Looi, 2012). More and more recognition is also given to the social aspects of learning, students' own agency, and collaborative knowledge creation (e.g., Bransford, Brown, & Cocking, 2000; Lee & Schottenfeld, 2014). Further, social relations have been identified as factors affecting student engagement (e.g., Kahu, 2013) and place attachment or "sense of belonging" to the university, which correlates, for example, with students' intrinsic motivation for academic study (Freeman, Anderman, & Jensen, 2007). While the aims of higher education seem to highlight the importance of collaboration and cooperation between disciplines, between students, and between students and teachers, students still work mainly individually and are encouraged simply to memorize and repeat the knowledge they have acquired instead of creating it with others. Further, many university facilities, such as lecture halls and auditoriums, are designed to support teacher-centered frontal instruction and lack opportunities for other forms of interaction.

It is commonly agreed that the physical environment influences how people feel, hear, see, and interact with one another, and that these factors, in turn, have an influence on the individual's cognition and affective performance (Jensen, 2005). In learning space design literature, more and more consideration is given to human factors, such as comfort and well-being in terms of affective and environmental factors (e.g., Jamieson, Fischer, Gilding, Taylor, & Trevitt, 2000; Prue, 2003; Oblinger, 2005; Radcliffe, Wilson, Powell, & Tibbets, 2008). Discomfort, for example, is usually not determined by a single factor but is instead an integration of various physiological and psychological factors (Cao et al., 2012).

Further, spatial design communicates meta-messages that influence how people engage with one another and whether they are able to fully participate in activities (Lippman, 2002; Lippman, 2013). Therefore, it is crucial for campus developers to understand how the principles of learning can guide space design (Jamieson, 2003). Spaces that enhance collaboration and human interaction rarely support focused work and vice versa. In consequence, questions of how interaction and participation might be supported through spatial design become essential when designing spaces for learning. Space can also be seen as a vital tool for leaders pursuing organizational changes (Höykinpuro & Ropo, 2014). Various studies suggest that, by transforming the spatial environment, the operational culture of educational organizations is much more prompt to change (Kallio, Kallio, & Blomberg, 2015; Kuuskorpi & González, 2011). Yet, spatial innovations are effective only when they are supported by the administrative practices and development of operational culture (Harrison & Hutton, 2014). By involving users in the design process, users become more aware of the existing and alternative ways of performing, which may lead to a better understanding of the learning spaces and their potential. Furthermore, such involvement helps users to

explicate the underlying ideology behind their ideas to the designer, which may help designers to implement those ideas into the design. This calls for new practices and a co-creation culture for real estate and construction clusters devoted to education in which traditional spaces are becoming less meaningful and the importance of informal learning spaces is increasing.

Research Method

A qualitative case study approach was chosen for this research because it allows the study of complex contemporary phenomena within their real-life context using multiple sources of evidence (Baxter & Jack, 2008; Yin, 2003). During this case study, a 400 m^2 location was redesigned at the Department of Music of the University of Jyväskylä to better support the core activities of the institution. The timeline of the project is illustrated in Figure 2. The project is divided into four phases: 1) visioning and concept design, 2) technical design, 3) construction, and 4) premises in use. The first phase of the project comprises the initial meetings between the key stakeholders and the facilitation of the charrette. The second phase comprises the steering group and design meetings. The third phase includes both construction and final planning culminating in the handover, which starts the final phase of the location in use.

[Figure 2 near here]

The property owner, University Properties of Finland Ltd. (UPF), recognized that the users' know-how cannot be embedded into designs via traditional design methods. In the traditional process of building, the parties are changed during different stages of the design and construction process. Further, this case study was premised on evidence-based design and previous demos UPF had carried out.

At the beginning of the project, a steering group that involved individuals representing users, owners, facility management, research, and construction was commissioned to ensure that the voice of the stakeholders was heard throughout the project. The steering group coordinated the project and the participatory workshops. It was also responsible for sharing information and was part of the decision-making process throughout the steering group and construction meetings (see Figure 2).

Design can be seen as a tool for establishing shared vision and creating holistic solutions (National Charrette Institute, 2011). Therefore, a facilitated participatory workshop charrette method was chosen in order to build consensus among stakeholders and to increase user involvement (Lindsey, Todd, Hayter, & Ellis, 2009). A charrette is a collaborative planning and negotiation process during which various stakeholders meet with designers to produce alternative solutions and coordinate them into a concrete plan (Naaranoja, Ketola, & Niemi, 2015). A charrette involves participants engaging in a co-design process that is highly structured and carefully facilitated (Lennertz & Lutzenhiser, 2003). In this case study, approximately 50 individuals participated in a five-day design workshop charrette to propose and analyze new spatial solutions for higher education. The charrette was divided into two parts: two days in December and three days in January. Participants represented different user groups – students, teachers, researchers, facility management, campus developers, and musicians. Also, an architect and a design coordinator were involved in the co-creation process in order to bring in facts and to offer options from the construction and design industries. Additionally, professionals from different fields were invited to give inspirational speeches, and visits were made to spaces significant to the design.

Co-creation consultants were responsible for the preparation and facilitation of the charrette. They guided and focused the discussions, captured the main ideas, and

made sure that the details and the big picture were looked at concurrently. The charrette workshops included lots of drawing to help illustrate the complexity of the problems, and various creative tasks encouraged participants from different disciplines to abandon their usual working patterns and to think outside the box. These tasks included various discussions about and "hands-on" tasks (such as handicrafts with cardboard and paper) illustrating proposed spatial solutions. All the workshops took place in the space for which the plans were being made.

Data Collection and Analysis

Data were gathered systematically throughout the project. Data from the visioning and concept design phase (i.e., the charrette materials) draw a picture of what was planned together with the end-users. It comprises meeting memos, designs, expert-evaluations, and summaries of discussions that offered user perspectives on space design. This means segregation from traditional design practices (such as architects' vision-based design), thereby providing more possibilities for an authentic user-centered approach. Materials from the technical design and construction phases comprise all the memos from the project meetings, allowing us to follow the decision-making chain throughout the project and to find connections between the design and the final product.

The space utilization was measured and qualitatively studied by video observation of how space is actually being used. Also, the booking information of the space was used. Video recordings were conducted twice during the project using time-lapse cameras. A four-day recording was shot in the space to be renovated before alterations, and a second video was shot six months after the implementation. During the first six months of use, user experiences were gathered using a survey. The survey included five open-ended questions regarding anticipated use of the space,

atmosphere, positive and negative aspects of the space, and other comments. Surveys were placed in the renovated premises and were available to everyone entering the space. A total of 54 users answered the survey (48 students, five staff members, and one musician).

The charrette materials were analyzed using a predominantly inductive content analysis (Thomas, 2006). From the data, meaningful analysis units were encoded to discover the user needs. Coded data produced three main categories of user needs: infrastructural, practical, and emotional. The same categories were used to analyze the project documentation and user surveys. Video data was analyzed using observation. The space was divided into three spatial areas: Club and Stage, Studio, and Showroom (see Figure 3). The usage of the space was divided into three forms: quick visit (< 5 minutes), visit (< 30 minutes), and stay (> 30 minutes). Also, the type of activity was encoded (reading, working, singing, etc.).

[Figure 3 near here]

Results

Project Goals

At the beginning of the design process, it was decided that the new space would be an informal 24/7 learning space for students and other user groups. The data analysis of the charrette materials revealed four orientations that guided the entire design process: future-, music-, research-, and academic-orientation. The aim was to create a space that would support a culture of spontaneous experimentation and a new learning paradigm. Since the facility is part of the Department of Music, it has to support the particular needs of music education and partners outside the campus. Later, the central

stakeholders and users defined three more goals for the project: 1) increased use of space, 2) sense of ownership, and 3) improved image of the discipline.

The space to be renovated used to function as a canteen. After the restaurant activity was shifted to another location, the facility was left without a purpose, and the anticipated utilization rate was low. Video analysis from the usage supported this presumption. During the video recordings, the space was mainly used for passage to the auditorium and quick visits to the coat rack. Only 19% of the visits were longer than five minutes and 5% longer than 15 minutes. Therefore, the first goal of the renovation project was to increase and diversify the space usage. In pursuit of a sense of ownership, the co-creation charrette method was applied.

The Musica building is among the first buildings that can be seen when entering the campus area from the city center. It is an important element that brands the whole university and a convenient place to organize events. Although it is the main building of the Department of Music, music was nowhere to be seen, heard, or sensed in any way. Therefore, one goal for the project was to improve the image of the Department of Music.

User Needs

The content analysis of user needs resulted in three main categories: infrastructural, practical and emotional (Table 1). These categories are described below.

[Table 1 near here]

Infrastructural

In this study, infrastructural factors refer to the fundamental underlying systems and services necessary for a built environment to function. Most of these factors stay hidden during conceptual design, but they have an enormous effect on the usability of spaces.

Usually, infrastructural factors are the ones users do not want to think about and that are discussed only when they do not work. During the charrette, users developed three themes related to infrastructural factors: safety, facility management, and information sharing.

As the space was supposed to be open 24/7, new means of ensuring security were needed. Access control, increased security monitoring, and locking systems were considered to ensure that only known users had access to the new facilities at night. Principles of universal design, such as accessibility for people with disabilities and equitability, were taken into account.

The new ways of doing things raised questions about how the facility should be managed in the future. Documents included notions of cleaning, event arrangements, booking systems, and maintenance. Information network connectivity was embraced. In order for people to know what is happening in the space, a new display system with audio speakers was requested. Further, some technical alterations were discussed, such as renovating the ventilation system.

Practical

ractical factors refer to elements that are related to action. It comprises the key activities of the organization – in this case, learning, teaching, and research. Practical factors included the following themes: information sharing as tools for teaching, learning, and creating music; new learning; new campus culture; and fit-out/lay-out.

Music learning practices include many practical elements. Therefore, users highlighted that the technological equipment of the new learning space must support playing, listening, creating, recording, podcasting, and storing music. Possibilities for performances were hoped for. Also, tools for sharing information inside and outside the

space were seen as important. Information screens for informing people outside about the activities in the building were desired as well as tools and surfaces for receiving and presenting information inside. Yet, there was no aim to create a high-tech learning space. Instead, users wanted to have tools that are easy to use. For example, the traditional bulletin board was seen as an important channel for informal communication and should therefore be preserved.

Learning was seen as an interactive and manifold process that requires informal spaces. New ways of learning were seen as multidisciplinary and collaborative as well as individual and focused. This required a learning space that supports not only individual and collaborative but also organized and self-regulated learning. In addition, social gatherings and recreation were viewed as essential for academic learning.

New campus culture means activities and facilities that are not yet permanent parts of the campus culture, such as pop-up lectures, DIY-projects, saunas, performing stages, communal kitchens, or sleeping facilities. The idea of new campus culture was to break boundaries between disciplines and people as well as to develop new ways of working to prompt innovation and creativity among students and staff. The space was seen as a way to combine various art forms and innovative working methods with the traditional activities of higher education. All these requirements resulted in an idea of a multi-purpose learning space that supports various learning situations and cultural activities, especially musical performances. Dividing the space into several learning areas was seen as a practical and natural solution. At the end of the design phase, the architect completed the first draft drawing (Figure 2). In the drawing, the space is divided into six smaller spaces, each with a different function and design concept: Lobby, Club, Stage, Bar, Studio, and Showroom.

The idea of a multi-purpose learning space required special attention to acoustics and movable walls. In addition, users wanted the possibility to manipulate the environment in terms of sound-making elements and flexible furniture. Easy-to-move furniture was seen as a way to increase the versatility of the space, and hence the usability. Further, it was agreed that more flexible ways of managing the campus facilities needed to be developed. For example: who can make reservations, or who is responsible for opening and closing the separating walls?

Emotional

Emotional factors refer to experiences through senses. They comprise visual, auditory, and tactile sensations, cognitive processes, and subjective experiences. The image of the new learning space was important from the beginning of the project. However, there were some restrictions put on the wildest ideas due to requirements of the museum authorities.

Users wanted the outside of the space to reflect the activities happening inside. Music was emphasized as an emotional experience; it should be seen and heard. Music was seen as a key to influencing people's spirits. Users also wanted the interior design to include references to music.

Possibilities for exhibiting the innovations and research results of the department were seen as good ways to arouse people's interest and curiosity. Users also wanted the new space to develop a sense of belonging among its users, especially for students. The new space was envisioned as a rendezvous location for the university, the city, and the whole world – a space where everyone feels welcome and to which everyone has access.

Varying Level of Service During the Project

During the concept design phase, there was genuine enthusiasm for the participatory design. Sufficient dialogue was facilitated by the dedicated co-creator consultants in multiple design workshops, the results of which were transparent to each stakeholder. The results were presented to a wide public audience at an event, where the sketch drawings and miniature clay model demonstrated the future vision, and tape strips and pieces of cardboard demonstrated the modifications of the walls and other structures. The feedback was collected in random conversation by the workshop facilitators, and there were also flip charts for "wall writing." After the workshops, a rough cost estimate of possible modifications was delivered, and the first version of the concept was drafted.

The transition from the concept design phase to the technical design phase was actuated by moving from the creative workshops to regular meetings and from the creation of new elements to downsizing the scope of the project in order to remain within the budget. The cost cuts were obligatory as the elaborated cost estimate had revealed that the costs of the first version of the concept had almost doubled the budget. In the downsizing process, the user needs were prioritized with respect to the information gathered in the co-creation workshops. The guideline was that the stage should be implemented as well as possible and that all necessary cost cuts should be found elsewhere. This indicates that, at the beginning of this phase, there was still a spirit of collaboration present, as special meetings were set up to have a dialogue about how the customer would prefer to implement the cost cuts. Later, the discussion shifted to more technical matters. The user representatives were still present at the meetings, but their role was to comment on the technical solutions suggested by the designers and engineers. The user perspective was taken into account, but they did not participate much in the solution development. The way of working could be seen as having shifted

from participatory design to integrated design. BIM was not used in this project, but the design team was solving problems in a collaborative manner.

Here are a couple of examples of the collaborative design decisions. During the concept design phase, there was a notable need to get the club area to serve a lot more people than before. Originally, the area was designed for 30–40 people, but in the new plan, there would be about 100 people listening to music with the new movable wall closed, so the service level of the ventilation needed to be scaled up. This was a difficult task with a clear target for a mechanical engineer to solve in the technical design phase. The first solution was to upgrade the ventilation system for the whole floor to a much greater capacity, but that would have tripled the budget, so other options were needed. The task was accomplished quite quickly by allowing users to adjust the ventilation balance in a way that almost all of its capacity could be directed to one room. The cost of this modification was approximately one tenth of the first proposed solution. This solution was not considered to be foolproof, so the correct practices for using the premises needed to be discussed with the user representatives and the other designers. After the risks were discussed with the users, the solution was considered to be suitable even if there was some minor risk of misusing the ventilation.

Most of the matters taken up in the steering group and design meetings were related to infrastructural requirements such as the ventilation system, restrooms, access control, and fire alarms. However, there were some statements regarding users' practical needs, such as following up on audio-visual equipment procurements and instructions concerning the hypothetical use of artificial smoke effects (would they be allowed due to fire alarm functions). In a few cases, some emotional needs were also recognized. There was a statement in the documents about the acoustical curtains: they should be made of a good quality fabric so that the acoustical function would be

fulfilled. Also, in one case, the lack of emotional and practical need was recognized, as it was decided that the kitchen equipment would be minimized because none of the user groups saw the need for better equipment.

The technical design was accomplished on schedule, and after that, the contractor was selected. As soon as the technical design phase was over, the design coordinator was left out of the project. Only afterwards was it recognized that this person was the last active party involved in the project who had actively participated from the beginning (Figure 4). After this, the service level dropped dramatically, as described below.

[Figure 4 near here]

During the construction phase, the project team's attention was mainly focused on the question of "how to build" instead of "how will this be used." This was necessary in order to keep up with the schedule and budget, but it may have led to some hasty decisions. One example of this kind of situation was the way the wire installations for the outdoor speakers were handled. During the concept design phase, the users expressed that music heard outside the building would be an important part of the new image. When the users inquired about the wire installations during the construction phase, the project team stated that they would look into it. In the next meeting, they stated that there would be no wire installations for the outdoor speakers. Nearly the same thing occurred in the case of the acoustical curtains. Both of these elements were designed when the construction contract was made, but neither of them was installed by the time of the handover. Both of them were installed afterwards. According to these examples, it seemed to be quite random which of the features mainly related to emotional needs would remain throughout the project. In many projects, the designers and engineers gather at the site to solve emerging problems. In this case, there is no

documentation about such activity, so the service has not been at the level of concurrent engineering. The cost savings were not executed with respect for maintaining the designed quality.

Premises in Use

User experience survey responses indicate that there really was a need for a multi-purpose learning space. A majority of the respondents (f=43, N=54) reported that they would use the new space in the future. Reasons given for the use were related to the location being near the library and the long opening hours. Also, emotional factors such as the atmosphere and comfort provided reasons for using the space. Some respondents specified that this new learning space was the only free and available space for students and student organizations.

Inaccurate information concerning opening hours, the functions of the space, and the booking system were noted. More information and terms of use were needed. There was also confusion about the nature of the space. The concept of the space had changed during the co-creation process from a living room to a club/café, and as a consequence, some respondents were not pleased with the final outcome. In addition, some respondents thought that the alterations were not big and bold enough.

The new space was seen as a functional and useful environment for creating new cultural activities and organizing events as well as cross-disciplinary cooperative learning and social gatherings. Respondents expressed that the new space was a convenient place to study individually (supported by the acoustics of the Studio) as well as in collaborative ways due to the choice of furniture (big round tables) and the informal nature of the space. Yet, some respondents wished for clearer distinctions

between the focused work area and the collaborative work area. Sound systems and the stage were seen as facilitators for musical performances and other organized events.

The new space was described mainly as peaceful, casual, and welcoming, but also as uncomfortable or even depressing. There were opposite opinions related to color choices and the usage of the existing furniture. During the first weeks of conducting the user survey, the space had some unfinished elements, such as the Flotex carpet. These unfinished parts received multiple negative comments. Some respondents were pleased with the lounge corner and furniture similar to that used there – soft and comfortable seats and colors were desired elsewhere in the space, too. The possibility of using adjustable tables improved the ergonomics of the space. However, not all respondents were even aware of this opportunity. Varied furniture, such as gym balls and bean bag chairs, was hoped for to increase the ergonomics and comfort.

The actual use of the space is illustrated in Figure 5, where red areas represent stays (> 30 min), green areas visits (15–30 min), and blue areas quick visits (< 15 min). It can be seen that the passages to the auditorium, the kitchen, and the restroom are working as they were planned. The Studio (above the middle) is mainly used for focused work, as intended. The work in the Studio was mainly individual, but there were also some group activities. In most cases, the user was a student working alone with a laptop and listening to something. Also, the Club area (left side) was used mainly for longer stays. The majority of these stays were group work situations or organized events such as a movie night or social gathering. The stage was only used for presenting movies and for one single performance. This indicated that the stage had not yet been used for the activities it was designed for. The showroom was mainly used for passage to the auditorium and the coat racks. The majority of the quick visits and visits involved waiting and chatting. There were also some people who stayed in the space for a long

time due to the computers located near the entrance. Furthermore, the spaciousness of the Showroom invited people to dance, play various instruments, and practice their conducting skills. The usage of the premises increased and the activity diversified, especially in the Studio and in the Club area, after the alterations.

[Figure 5 near here]

All in all, the new learning space has increased and diversified the usage of the premises. The activities are manifold, and users think it supports their purposes. However, the new creative campus culture that was envisioned during co-design was not very strongly present in the video data, nor was the usage of the stage. The space was mainly used for traditional academic activities. Despite this notion, the booking information indicates that there is a wide array of diverse activities involving the stage, such as seminars, parties, concerts, development days, and other theme days.

Conclusions and Discussion

The problem of understanding user requirements and transforming them into high-quality designs is a universal one that many industries have struggled with. The findings of this study provide a link between the users' perspective and the project management. While every discipline and educational level has its own unique characteristics, the results we have presented can be used generally to improve the design of learning spaces from the users' point of view. The infrastructural-practical-emotional framework can be used to improve the management of design and construction processes. The framework highlights the user needs that are relevant to the users yet widely neglected in the current practices of construction projects. The service level that fragmented actions provide is not sufficient because it seems to only recognize the infrastructural needs of the users. We suggest that the emotional and practical level of user needs could

be better understood when working in a collaborative manner. Therefore, in order to really make spaces that meet the needs of users at all levels (emotional, practical and infrastructural) and to increase the usability of new spaces, collaborative ways of working are needed throughout the entire project.

Further, this case study shows that collaboration probably provides a positive impact on the resulting premises, even though every single part of the project may not be successful. For example, in this project, the communication between the steering group and end-users was not entirely successful. Even though researchers actively attempted to share information about the possibilities of the space and spurred users to "own" the space, the purpose of the space remained unclear to users. It seemed that users were struggling when there was no fixed function to the space. Without appropriate guidance, creative campus culture was not developed even though users perceived that the new space supported it. This indicates that more attention should be paid to the handover phase and the guidance for using new premises. In a building project, it is quite often the contractor's responsibility to provide instructions on how to use all of the new equipment. Yet, according to our study, the contractor acts mainly on the level of infrastructural needs – not the use of the premises. Our study supports the notion that collaborative ways of working throughout the entire design process are needed to ensure that all the levels of user needs are acknowledged.

Even though we consider participatory design a very high level of service, it is not a concept without downsides. The active role of the owner seems to lead to opportunities for co-creating value-in-use with users in the concept design phase. However, this case shows that the use of participatory design in the concept design phase does not necessarily guarantee success. The accomplishments can be undone in the later phases of the project as the user-centered approach might be lost. In our case,

some features of the required quality were lost in the construction phase because the decision-making and supervision were fragmented. There was no stakeholder in the decision-making process of the construction phase who would have understood the holistic approach of the required quality. The same could also have happened in the technical design phase if the list of requirements that the participatory design had produced had been misunderstood.

Another downside is that proper collaboration requires a lot of effort of both the service provider and the customer. Participatory workshops and the meetings after that take lot of time from both sides, and handling the vast amount of information that participatory design produces requires a great deal of cognitive effort. Thus, we recommend that if the collaborative design approach is pursued, it should be done with a strategy that implies how to maintain collaboration at each phase of the project and during phases when the customer has less to say.

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Table 1. Content analysis framework including the main categories and sub-categories and their descriptions.

	Categories	*Descriptions*	*Examples from the documents*
Infrastructural	*Safety*	Safety is guaranteed by an appropriate access system; accessibility for all	How can it be assured that people cannot go upstairs or downstairs at night? (M)
	Facility management	Facility management includes services and systems that are needed in the new space, such as a booking system and functional ventilation.	Easy to keep clean (P) Schedules and booking need to be considered carefully. (E)
	Information sharing	Information is shared locally and globally; requires purpose-based technology; maintenance and ownership of information-sharing channels	A chance to connect with and entertain people around the world (M)
Practical	*Information sharing*	Technology and tools for teaching and learning; information sharing for visitors and users	Info screens: for students, for visitors, for people going out (C) Bring your own device or technology into the space? (M)
	Learning	New learning is interactive and manifold; learning requires informal settings; learning is engagement; learning music is very practical	We can't write our creations, we need to play, record, and listen. (M) privacy - my bubble, my world (M)
	New culture of activities	Learning space is open 24/7; it is a center for social interactions; it facilitates relaxation	It is always accessible and available for ad-hoc use. (C) campus sauna (M)

Table 1 (*Continued*)

	Categories	*Descriptions*	*Examples from the documents*
Practical	*New culture of activities*	New campus culture breaks boundaries between disciplines	Exhibitions are done in cooperation with other faculties (art, history) and with parties outside the university. (C)
	Fit-out/lay-out	Multi-purpose space; multiple activities can be arranged simultaneously	Stage can be oriented towards Club or Studio, or both simultaneously. It can also be closed. (C)
		Manipulative space; flexibility	Users can manipulate the environment and the phenomena in the space. (M) Everyone should be able to participate in making sounds. (M)
Emotional	*Image*	Image of the department of music; music as an emotional experience; music technology and instruments in view	Lobby is an abstract that gives a promise of what one can expect going further inside (S)
		Image of the university; novel learning space for students; has to fit the context	... space that tells what the university is now (breaking the old perceptions) (M) This building is part of the time-honored campus (M)
	Comfort	Comfort includes aesthetics and acoustics, ergonomics, and atmosphere	different spaces for different moods (soundscape and colors) (M)
	Communality	Communality is enhanced through encounters of people; the sense of belonging	Easy to come in and meet people (C)

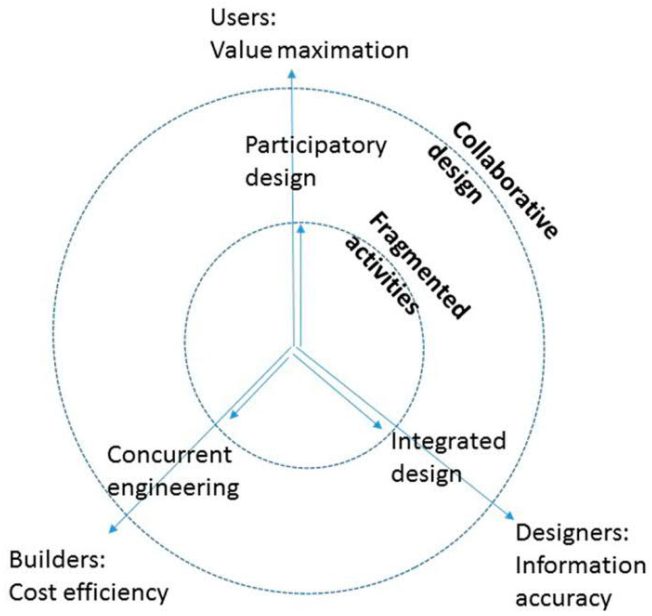

Figure 1. The relationship between participatory design, concurrent engineering, and integrated design in design and construction processes.

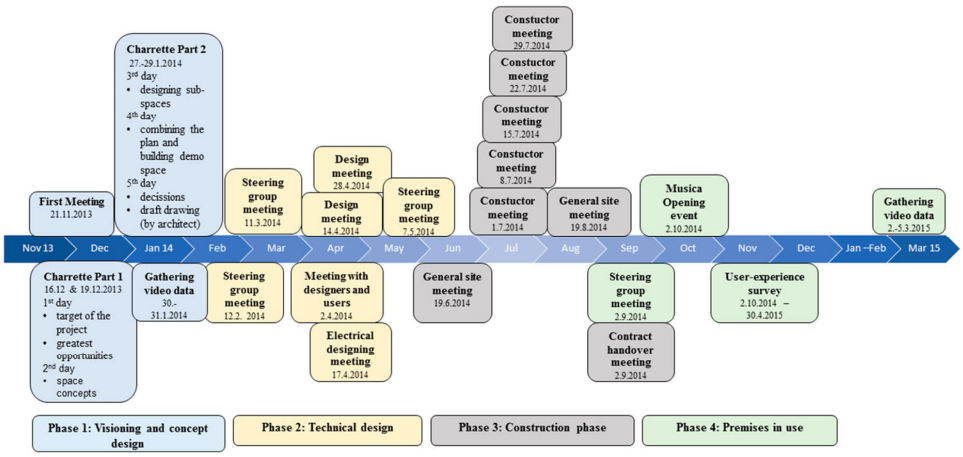

Figure 2. Timeline and phases of the co-creation process

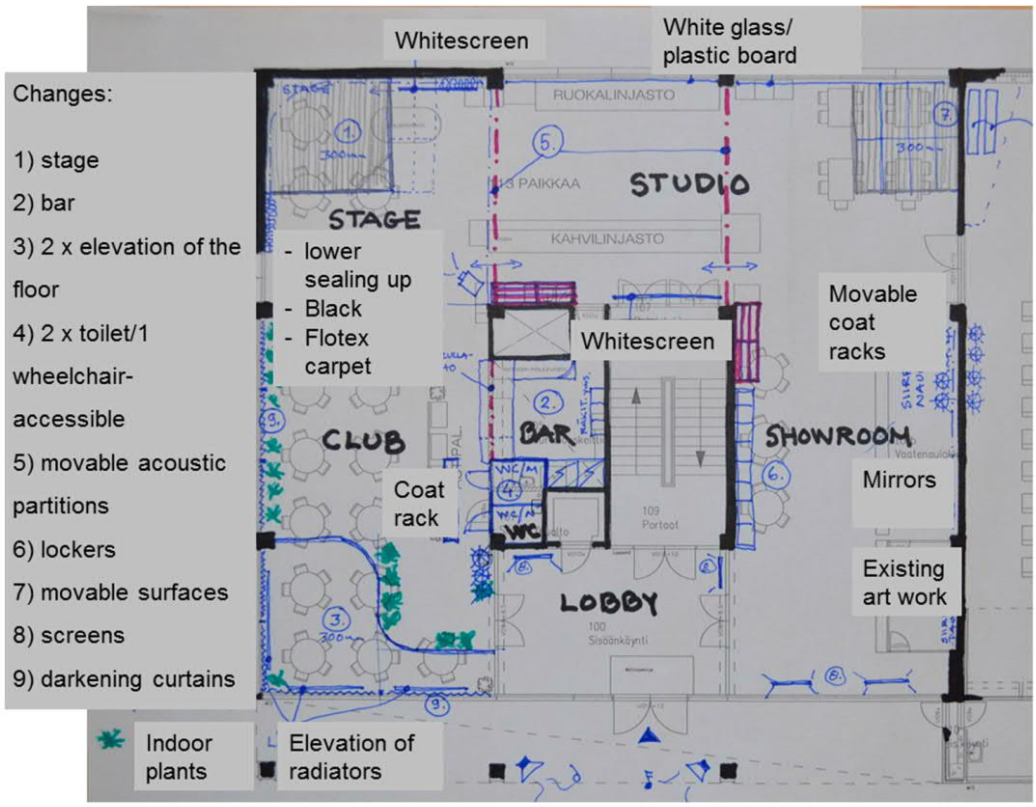

Figure 3. The first draft from the architect

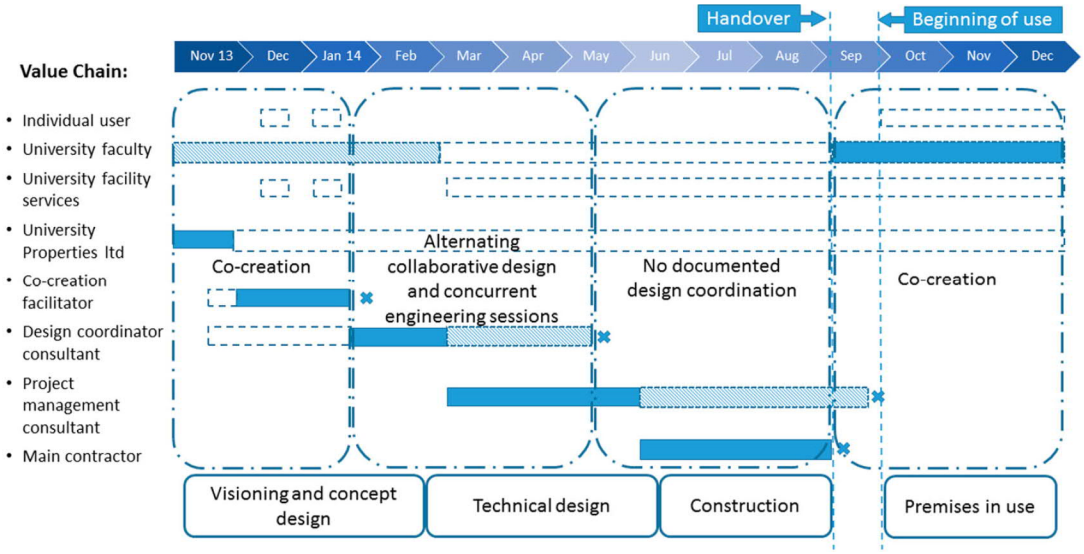

Figure 4. The participatory timeline. The chart shows that after the technical design phase there was no active party left who was present when the concept was formed in the co-creation workshops.

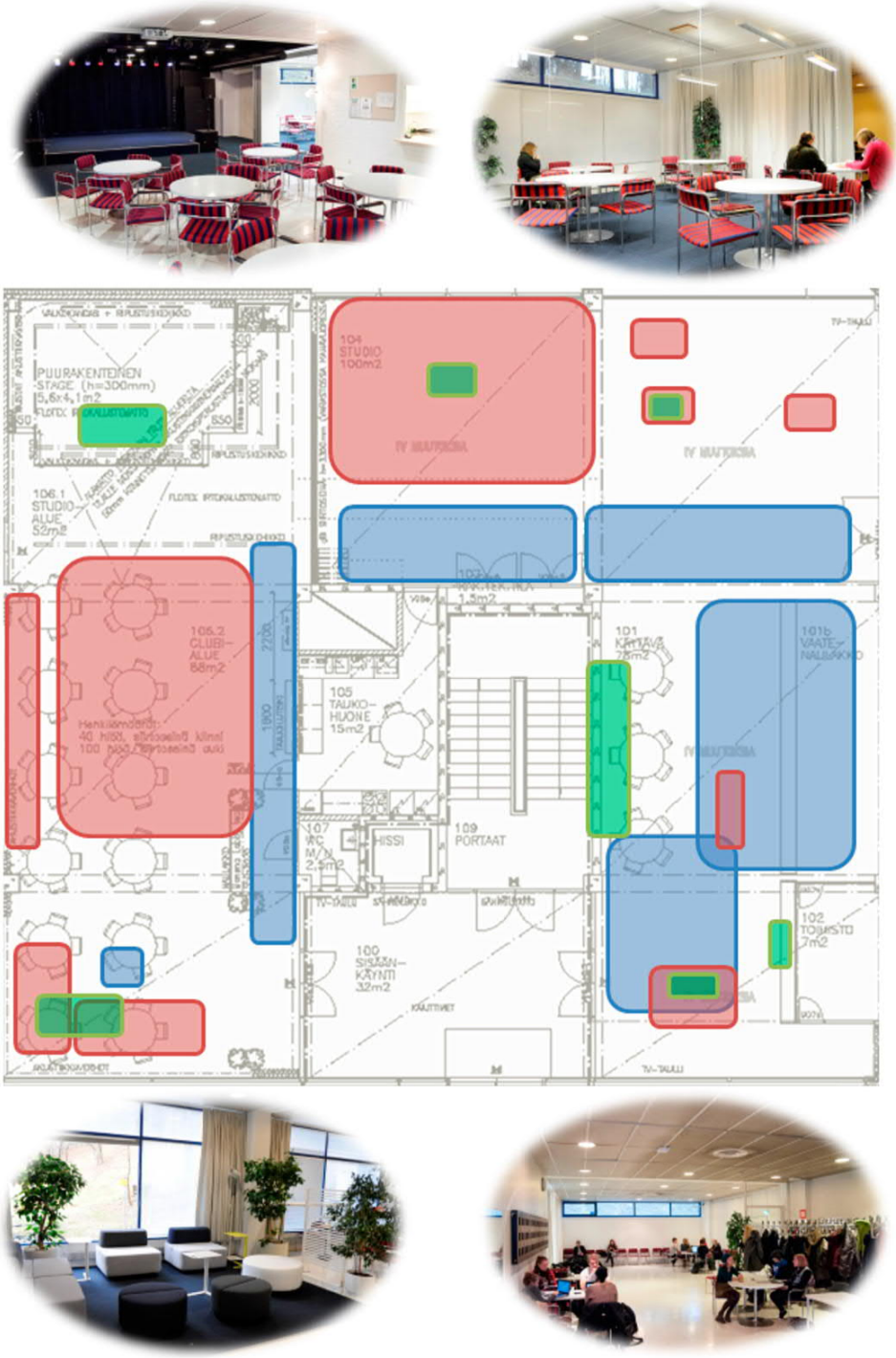

Figure 5. Usage of the new learning space. Blue areas represent quick visits, green are visits, and red areas are stays.

III

NUISANCE IN COMMUNICATION BETWEEN FACILITY USERS AND BUILDER: A LANGUAGE BARRIER

by

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Nuisance in communication between facility users and builder: a language barrier

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Abstract

The aim of this research is to observe the barriers in communication between the construction project organisation and facility user organisation. Along the project the user organisation and the construction project organisation have many occasions where they communicate about the future premises but their perspectives are quite different: the user organisation's main concern is how the premises can be used whereas the construction project organisation's main concern is how the premises can be built. Moreover, both organisations deal with the concerns with their own professional jargons. The research question is how the communication and terminology should be established in order to co-create a mutual goal for the project?

The method of the research is case study. The case is a learning space retrofit project in the Musica building that is located in the university campus in Jyväskylä, Finland. The new learning space was co-created through user-centered design workshops. The case is studied by using content analysis to various documents. Documents include materials produced during design workshops (drawings, summaries of discussions, expert-evaluations, and concept designs), memos from official meetings and the user-satisfaction survey comprising statements and open-ended questions regarding the new space and its potential.

Results are indicating that the construction project organisation struggles to understand which features of the project are necessary from the user organisation's point of view. In addition, there are indications that the success of the project is understood very differently between these organisations.

Keywords: retrofit, user-centered approach, co-creation, construction project management, customer satisfaction

1. Introduction

The focus of the builders and the users of the buildings can be very different from each other. So can be the language they use. The communication problems have been identified as a major element in problematic cases (Thomas et al 1998) and consequently, there are studies of communication tools (e.g. Nitithamyong and Skibniewski 2004). However, the perspective of the language used in everyday communication of building projects has not reached such interest. There are some studies about how cultural differences including language problems may make project management more difficult (Ochienga and Priceb 2010), but the language barrier may exist even if the stakeholders have a common cultural background. The purpose of this research is to provide additional understanding about communication problems by studying the differences of the language and jargon that is used by the construction professionals and the users of the building.

The building project team consists of stakeholder with different roles. There are at least the roles of designers, implementers (builders), property owners and users (tenants) (Savolainen et al 2015). In addition, there are the roles of project management and design coordinator, who orchestrates all the other roles. As the value chain goes the tenant organisation pay rent to the property owner who does the investment and pays to the designers and implementers. It is understandable that each stakeholder develops their competence and communication in relation to their purpose of existence i.e. in stem with the value chain.

The roles can be divided into two categories according to the purpose of existence: the users and the others. The purpose of all the others is to ensure that there will be premises to use whereas the users' purpose of existence in most cases has nothing to do with the existence of the premises. Premises are simply one tool among others and the user could implement its purpose in any other premises as well. Thus, the competence and jargon of the users have a little to do with the competence and jargon of all the others. The purpose of the existence also determines the focus of each stakeholder: The users focus on how the premises may be used whereas all the other roles focus on how the premises may be built up.

The data of this study consists of the documents from co-creation workshops that were used for concept designing, the meeting memos of the technical designing and construction phases and the satisfaction survey that was implemented after the occupation of the premises. In the concept design phase, the user role was well represented and the documents are written in users' language. In the technical design phase, the user was still represented, but the focus in the documents was shifted into the accomplishment of the project. In the construction phase meetings, the user role was absent. The user role was re-established immediately after the contract handover when the user group took over the premises and the occupation begun.

The satisfaction survey was implemented twice in the first half year of occupation. The survey was designed so that on the one side there were questions that evaluated the premises' fitness for the activities it was designed for, and on the other side, there were questions to assess the success of the design and implementation. That way it was possible to observe differences in

satisfaction expressions between the evaluation based on activities (users' language) and the design and implementation quality assessment (construction professionals' language).

The research gave an interesting insight into the fundamental problems of communication between the professionals of the construction industry and real-estate management and their clients. It gave a novel understanding about how the professionals and their clients view the result of the building project from significantly different perspectives.

2. Theoretical background

2.1 Understanding the importance of professional communication and language

The ways in which experts in the field of real-estate project development understand communication and language, as a dimension of their professional competence, are questions barely explored. In our current knowledge-intensive and meaning-based work culture where shared understanding becomes extremely important, work processes are fundamentally communicative (Kostiainen 2003). Alongside to concrete matters considering the building projects experts in the field of real-estate project development must be capable of abstract and symbolic thinking when doing business with various clientele. Communication and language have a very important role when users evaluate and construct their experience of built environment, spaces and places (e.g. Airo 2014, 12). Information has to be shared for the benefit of everyone who needs to exploit that information in the user-organization. Information mediation and development happen in diverse interactional situations in which appropriate communication competence and understanding of each fields' professional language is needed.

Thus, evaluation of professional competence is less based on employees' status or activities than on their skilful expression of competence in various contexts. Professionals must speak on behalf of themselves and the results of their work, which may be very abstract ideas as well as the creation of common knowledge. The impression of an employee's competence or incompetence in their work is increasingly based on interaction with others. (Kostiainen 2003; Laajalahti 2014.)

In general, communication processes in working life can be considered from the point of view of information exchange or meaning (see Frey et al, 2000, 27-28; Littlejohn, 1999, 6-9). The former emphasizes communication as a tool for transferring information from one source to another. Communication is seen as intentional message production and information exchange. A meaning-based perspective, on the other hand, emphasizes reception and interpretation. As Airo (2014, 19) states 'the built environment is always the institutionalised object of a social process'. Thus, in the field of real-estate project development, the communication process should primarily be seen as a receiver-centred, and as user-centred sense-making process. Nowadays it is extremely important to have a profound understanding of the connection between communication, language and ones' expertise in built environment business and management.

Interpersonal communication in relation to professional competence is increasingly a theoretical as well as a strategic way of thinking, understanding and orientating oneself, as well as a way of taking a stand, viewing and comprehending work and interpersonal relationships there. In relation to interpersonal communication competence, it is less important to define how we should do something or what we must able to do, than what kind of thoughts about communication we should hold. (Kostiainen 2003.)

2.2 Users' role in construction project

Cherns and Bryant (1984) point out that the role of the client is hard to examine because there are things that people are willing to state differently depending whether they are talking privately or in public. Their research is based on private confidential discussions, and thus, it is supposed to give quite an accurate image of the essence of the client's role. About the role, they point out that the client should not be regarded as a unitary concept. Even though the project would be organised so that there is only one nominated contact person who communicates with the construction professionals, behind of that is a complex system of interest groups that sometimes even compete against each other. As the construction project organisation is temporary multiorganisation (TMO), which means that there are lots of people from different firms that are gathered together to accomplish a project within a limited time period, the construction professionals have very limited time and mental capacities to take over all the complexities of the client organisation. That makes them impatient and vulnerable to oversimplifications. The involvement of the client system and its influence within the TMO is high in the initial phases. Thereafter involvement tends to be remitted to the lower levels of hierarchy within the client system which retreats into a reactive mode. So in many cases, the objectives may be initially insufficiently understood because of the oversimplification of client organisation and needs, and the client organisation is not suggested to correcting the misunderstandings as they are supposed to be in a reactive mode. (Cherns and Bryant 1984)

Of course, this is just a general description and there have occurred initials to break this vicious loop of oversimplification and reactive mode. Lindahl (2004) for example has described the method of workplace design that originates from the 1970s. Initially, the workplace design meant that the architect concentrated on employees' perspective and the quality of working environment was embraced. The embracement of the employees' perspective leads to the development of the participatory design methods, especially in Scandinavia. But even though the participatory methods did enhance the possibilities to understand the complexity of the client organisation such elaborate design has not necessarily guaranteed the promised improvement in the performance of work. On the other hand, some workplaces without perfect working conditions or carefully designed aesthetics are recognized as well accepted by employees and effective environments. Hence, Lindahl (2004, 254) suggests that "there is a lack of terms that facilitate a discussion on workspace design and organisational performance". In the research there are identified four aspects to categorize terminology and discussion: Work environment qualities (health and safety), metaphoric and symbolic qualities (corporate image), dynamic and contextual interdependence (actions of the organisation) and degree of participation in the design process (Lindahl 2004).

There has emerged quite significant interest in many industries towards co-operating with the customer. For example, the service dominant logic that states that "customer is always a co-producer" (Vargo and Lusch 2004) has gained recognition as a key marketing concept (Grönroos and Voima 2013). Prahalad and Ramaswamy (2004, 1-2) takes the level of co-operation a bit further as they embrace the significance of co-creation as a driving force for competitive advantage. The basic distinction is that Vargo and Lusch (2004) suggest that customer may be part of the value creation process in every stage of the production whereas Prahalad and Ramaswamy (2004, 49-50) suggest that production process should be designed so that it is actually a chain of value co-creation experiences. Grönroos and Voima (2013) points out that there are still lots of unambiguous concept definitions missing, like the concepts of value and value creation, that are needed in order to find usable managerial implications.

3. Data and Methods

3.1 Case study description

In this case study, 400 m2 premises were retrofitted at the University of Jyväskylä, Finland to better support the core activities of the organization. Before the project, there was a quite popular lunch café at premises, but the café was moving to another building at the campus, so there were well know premises becoming vacant. All other premises in the building were occupied by the department of music so it was decided to develop the premises to support learning, presenting and exploring music.

In our research case, the property owner University Properties of Finland Ltd. recognized that the users' vast knowhow about learning, presenting and exploring music cannot be embedded into architectural designs with traditional design processes. Therefore, a facilitated design workshop method called charrette was chosen as the main approach in order to improve the quality of the design and to find opportunities to co-create value-in-use. The co-creation project is divided into four phases that follow each other: visioning and concept design, technical design, construction and premises in use. The visioning and concept design phase of the project comprises the initial meetings with the key stakeholders and the charrette co-creation workshops. The technical design comprises the steering group and design meetings. The construction includes both construction and final planning ending with the handover, which started the final phase with the location in use. The co-creation project was part of a national Indoor Environment research project that aimed at designing evidence-based educational spaces for knowledge creation.

3.2 Research method

This research case was divided into three steps:

Step 1: What kind of guidelines and aims for the project were outlined and what kind of needs were generated during participatory workshops (charrette)?
Step 2: Was the evaluation of achieving those aims successful using a satisfactory survey?

Step 3: What kinds of observations were made related to language and communication in the project documentation?

Various types of data were gathered systematically throughout the project in order to examine the whole process: charrette material (data produced during design workshops), memos and minutes and satisfaction survey. All this data combined forms a rich base for the analysis and offers essential information about each phase of the project.

Materials from technical design and construction phases comprise all the memos and minutes from various project meetings. These materials can be seen as a perception of the person responsible for managing the project at the time. It reveals the builders' perspective and their jargon. During the next six months after the implementation, user-experiences and first impressions were gathered by using a satisfactory survey.

The survey was designed so that there were on one side statements that evaluated the premises' fitness for the activities it was designed for (fitness for purpose). On the other side, there were statements that assessed the success of the design and implementation as well as included five open-ended questions regarding the possible use of the space in the future, the atmosphere of the space, the positive and negative aspects of the space and other comments. That way it was possible to observe differences in satisfaction expressions between the evaluation based on activities (users' language) and the design and implementation quality assessment (builders' language) (Step 2). A total of 54 users answered the survey. The majority (f=32, N=54) of the respondents were students from the Faculty of Human sciences, which includes the Department of Music. Altogether, 48 students, five staff members and one musician completed the survey.

Charrette materials and open-ended questions from the survey were analyzed using a predominantly inductive content analysis (e.g. Thomas, 2006) in order to identify the aims of the design, e.g. requirements for the space. Data was segmented into meaningful analytical units that were encoded. Codes were then divided into (one or more) categories.

The analysis of the multiple choices was conducted by applying the logic of Net Promoter Score (NPS). NPS is developed by Reichheld (2006). The main logic is to divide respondents into three categories: promoters, passive and detractors. The score is calculated by subtracting the number of detractors from the promoters and dividing the sum by the number of all respondents. Those respondents that give undisputedly positive signal on satisfaction can be recognized as promoters. By following that logic, the analysis was conducted by examining the strongest positive answers in relation to other answers in each question.

4. Findings

4.1 Communication in the project

The broad vision of the new space was constructed during the visioning phase that was implemented by participatory workshop process called charrette. The result of the charrette was

a spatial concept which included several spaces with different purposes: the stage which was place for presenting live music, the club which was place for both studying in groups and listening the music played on stage, the studio for focused working, the bar that could be used for refreshment providing in organized event or for making coffee if the club was on study use, the show room for place where achievements of the university's department of music, and entrance that would welcome the visitor to building. Analysis of the charrette materials revealed the framework which comprises four guidelines for the concept design: future-orientation, music-orientation, research-orientation and academic-orientation. Later three more defined goals for the project were created: 1) increased use of space, 2) sense of ownership and, 3) improved image of the discipline. In the visioning and concept design phase goals, guidelines and users' needs were communicated in users' language within their context.

At the end of the concept design phase, the objectives of the development were shaped into a form of feasible project. Also, the way of managing the meeting was changed. The focus was shifted from the creative discussions of what should be done into how to accomplish the project within the schedule and the budget. But despite this shift, the user perspective was not forgotten during the technical design phase. However, when the construction phase begun, the users' role was diminished so that they were present in hardly any meetings. User group was reorganized after the handover meeting. The minutes of the user group meeting, which was held immediately after contract delivery handover meeting, present indisputably that there has been a major misunderstanding between the users and builders, and the project management organisation was not capable of dealing with it.

We don't present all the possible misunderstanding that there were, but we take three enlightening examples to present the nature of the language barrier between the users and the construction professionals: curtains, fire detector system modification and outdoor speakers. Common to these three examples is that users' requested all of them in the technical design meetings, but only the fire detector system modifications were delivered. Curtains were discussed in the design meetings because blocking the windows was considered as a vital part of the acoustics. There was a written statement in the minutes that the acoustical curtains will be included in the construction contract. The curtains were also presented in the contract drawings but they were not delivered by the handover. The story is quite similar to the outdoor speakers. They were decided to include in the project because it is important to the place's image that there is an option to play music from the stage straight to the outdoor. The procurement divided so that the user should provide the speakers and the contractor should install the cable and arrange the demolitions and fix-ups for the cable route. Both the speaker cable and the curtains were installed after the handover.

The story of the fire detector modifications was a bit simpler. The modification for the detector was needed because the artists want to use theatre smoke at the stage. It was stated that this can be done by changing a couple of detector units and adding a module to the central unit of the system. The modifications were implemented according to the plan. When comparing these three stories there occurs a question, whether this is random behaviour to accomplish some assignments and ignore others or not.

4.2 Satisfaction expressions

Answers to the open-ended questions were divided into three major categories: infrastructural, practical and emotional. These categories have been described below. The answers were analysed by first recognizing which category each comment fall into and then forming a comprehensive picture of the content of each category.

Emotional factors were mentioned 140 times in the satisfaction survey. Emotional factors refer to experiences through senses by comprising visual, auditory and tactile sensations, as well as cognitive processes and subjective experiences. Comfort was the most commented theme, especially the atmosphere and aesthetics. Respondents described the new space as peaceful, casual and welcoming. Most of the responses were positive but there were also negative aspects. Few respondents stated that the space is uncomfortable or even depressing.

Practical factors were mentioned 117 times. Practical factors refer to elements that are related to or resulting from action. It comprises the key activities and factors that facilitate the core processes of the organization, in this case, learning, presenting and researching. Practical factors were related to all the same themes as in the charrette material: information sharing, learning, the new culture of activities and layout. New space was seen also seen as an environment for creating new cultural activities and organizing music events as well as deep cross-disciplinary cooperative learning and co-teaching.

The infrastructural factors were mentioned 8 times. They refer to the fundamental underlying systems and services necessary for a built environment to function. It compasses all the services and technical structures that enable activities in the space. These comments were related to information sharing and facility management.

Maybe the clearest indication of the significance of the language used can be found in the multiple-choice questions. When comparing the first survey answers to the second survey answers the change in the proportion of the best 5 = “completely agree” answers is striking. However, the development from the first survey to the second one is opposed between the question sets. The satisfaction seems to increase in the set that evaluates the usability of the premises (fitness to purpose) and decrease in the set that assesses the quality of design and implementation. The logical reason was searched from the terminology, and it seems that user is more capable of doing evaluation if the question directs to think the activity first and the space after that. The second set instead directs to think the space first and the effect on action after that.

When the question sets that evaluate usability are compared, it can be observed that the proportion of the best 5 = “completely agree” answers is significantly increased in the second set. This increase can be observed best in the questions “supports individual studying”, “supports small group studying”, “increases the wellbeing of the students” and “Increases the free association among the students”. It seems that during the first half of year the users became familiar with the space and the satisfaction of using the premises grew alongside.

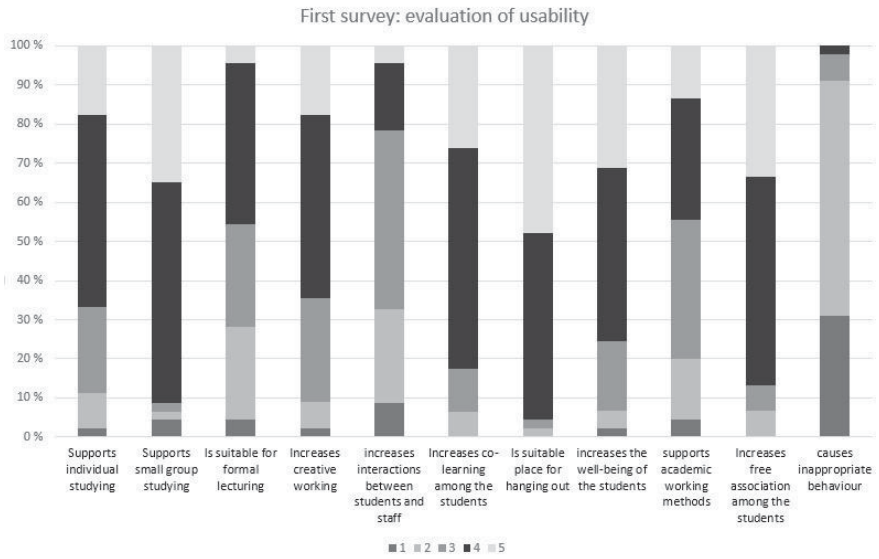

Figure 1: Evaluation of usability question set from the first survey

The growing share of extremely positive answers indicates that the growing satisfaction is not just about the increased understanding how the premises work, but that users actually like to work there i.e. they have become emotionally attached to the premises. Even though the development of the sense of ownership was expected, the result of the first set of the questions (evaluation of usability), the results of the other set (design quality assessment) was not. The best 5 = "Very good" answers had almost disappeared.

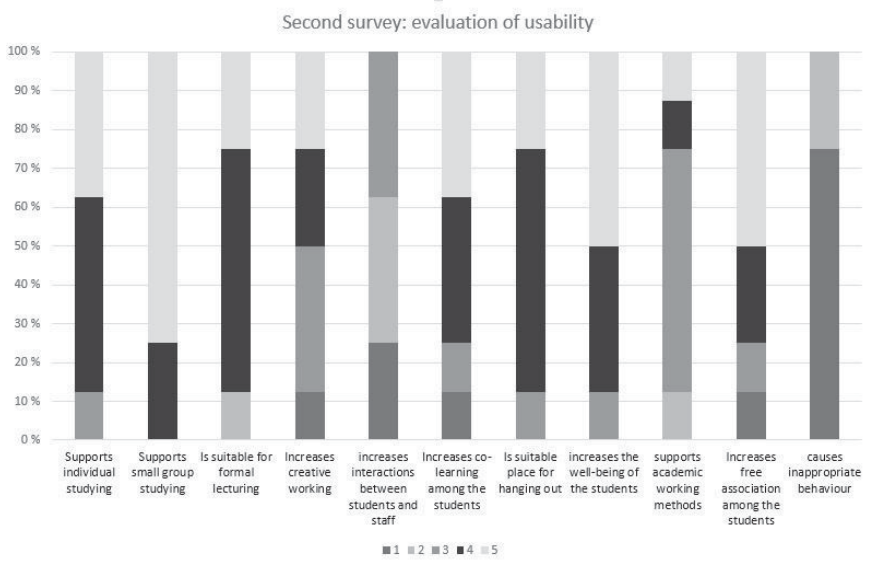

Figure 2: Evaluation of usability question set from the second survey

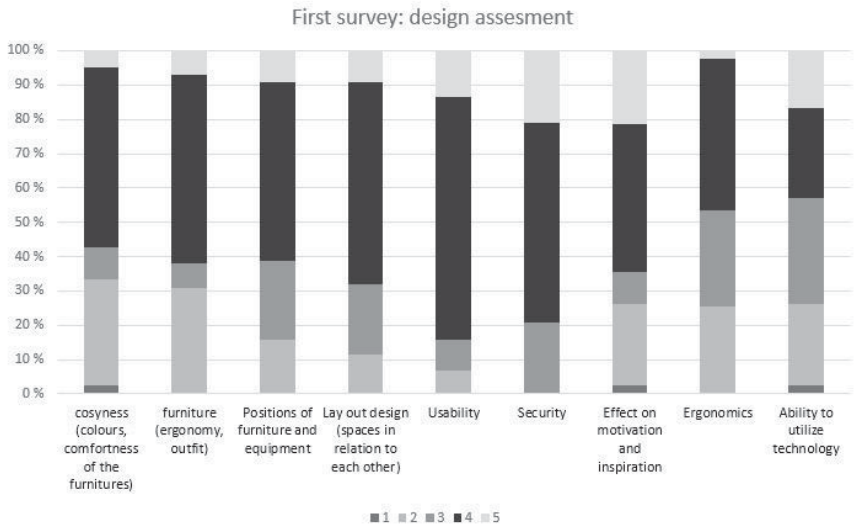

Figure 3: Assessment of the design and implementation question set from the first survey

The best answers were still present only in three questions "lay out design (spaces in relation to each other)", "security" and "ability to utilize technology". And the amount (around 20 %) was small compared with the results of the other set (around 50 % - 70 % at best). The greatest surprise was that even though the increase had been observed in the emotional attachment and sense of ownership, the question "effect on motivation and inspiration" totally lacked the 5 = "Very good" answers. So even though the space is an extremely popular place, the popularity is not perceived as a feature of the space.

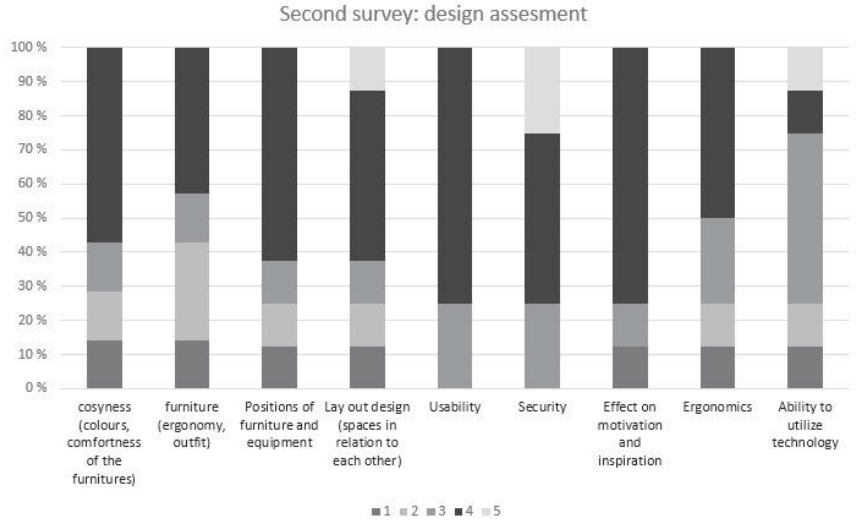

Figure 4: Assessment of the design and implementation question set from the second survey

5. Discussion

Our research supports Lindahl's (2004) perception of the user need categorization. The research confirms that there are needs concerning mainly health and safety (we call these infrastructural needs), needs concerning activities of the user (practical needs) and needs concerning metaphoric qualities and symbols (emotional needs). Lindahl (2004) also presents the fourth aspect that is a degree of participatory in the design process. Our research supports the assumption that it is a crucial aspect, but we would rather separate it from the first three. The first three aspects can be understood as user needs whereas the fourth one may be understood as a meter of which level of needs the service process has reached.

Our three examples of how user needs were treated during the design and construction phases (curtains, fire detector system modification and outdoor speakers) indicate that construction professionals tend to deal only with the features related to the infrastructural needs. There was no significant difference between these three tasks in schedule wise or budget wise. Neither there was a difference about how they were stated in the meetings. It was made clear that all of these are important for the user. The need for the fire detector system modification was related to infrastructural needs whereas the other two was related to practical and emotional needs.

6. Conclusions

Our study and our results are all but comprehensive description of the communication problems between construction industry professionals and their clients. Despite the fact that there were only eight answers in the second survey, our research provides evidence that the emotional attachment and sense of ownership are such qualities that are hard if not impossible to embed into space. The culture of the user group seems to have much stronger relation to these qualities than the premises itself.

If the infrastructural needs are compared with the other two categories, it can be realized that engineering safe and healthy indoor climate differs quite a bit from designing how the premises effect on human behaviour or human emotions. It may be that most of the engineers are willing to settle for handling the infrastructural needs: The outcome is much more predictable and needs much fewer adjustments afterwards. That way the engineer can be sure about the value he/she has to offer. But the downside is that the service and the terminology concerning the practical and emotional needs remain underdeveloped. As the oversimplification of the communication problems is supposed to be malicious, these problems will require a lot more research in order to find ways to offer services not only to the infrastructural level of needs but all the needs users have. We suggest that project management service providers could gain significant competition advantage via better understanding of needs.

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IV

INDICATORS OF COLLABORATIVE DESIGN MANAGEMENT IN CONSTRUCTION PROJECTS

by

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Indicators of collaborative design management in construction projects

Abstract

Purpose – Design management plays a significant role in value creation in a construction project. Within the last few decades new design tools like BIM have been introduced which supposedly enhance design productivity and quality. However, no such revolution of design quality has emerged. Therefore, more research on how design management affects the quality of construction project is needed. The purpose of this research is to better understand the connection between design management procedures and quality.

Design/methodology/approach - This is a case study with mixed method approach. The data collection strategies used are quantitative user satisfaction survey and qualitative analysis over the documentation of the case project.

Findings - A deductive analysis was conducted to four suggested indicators of beneficial collaboration. An explanation was found for how the quality of the project outcome can be forecasted from the management style and procedures.

Research limitations/implications – The research was conducted as single case study and therefore greater data would enable further development of the indicators.

Practical implications – The indicators have wide range of applicability: the clients can forecast the quality performance by evaluating the management procedures already during the project instead of waiting until the end of project. The indicator system provides also societal impact as it guides the clients to use the kind of managerial practices that improve the ability to create value in projects that are difficult to evaluate in money terms.

Originality/value – The research provides a novel way to gain a holistic view with analytical indicator tools. The research contributes to lean design management literature by providing insight to the underlying mechanism of beneficial collaboration.

Keywords: design collaboration; indicators; quality; construction project management; lean design management

1. Introduction

The collaborative ways of working have been considered a promising way of improving productivity and quality in the construction industry, but the management of beneficial collaboration is still quite unresearched topic. Even though there exist lots of collaboration-related research concerning construction project management, the focus is quite tool-oriented like in building information model (BIM) related research (Rekola *et al*., 2010; Sebastian, 2010), integrated project delivery related research (Kent and Becerick-Gerber, 2010), or in research related to single decision-making method (Kpamma et al., 2016)

Focusing on a single tool or practice makes the perspective rather mechanical. The indicators are variances in the output of each process stage (e.g. Salem *et al.*, 2006), so the perspective seems to extract human behaviour from the process. In some research, the human aspect is included, but the quantitative approach reduces human existence to a couple of indicators such as units-per-man-hour, safety, cost, rework and so forth (Suermann and Issa, 2009). Those kinds of indicators do not sufficiently describe the effect of collaborative behaviour.

On the other hand, the problem with design quality indicators is that they cannot be used before the building is finished. Such indicators are in many cases derived from the ancient tripartite formula of utilitas (utility) – firmitas (firmness) – venustas (delight) by Vitruvius (e.g., van Voordt, 2009). The design quality indicator (DQI) is an example of this kind of thinking, as the core of it is a questionnaire that focuses on functionality, impact and build quality (Gann *et al.*, 2003). No matter how the design quality is analysed within this context, the result is an analysis of the features of the

built outcome. These kinds of indicators are useful for evaluating competing design solutions but offer little help in managing the process toward better quality.

Both the process indicators and the design quality indicators are important and useful tools for managers, but indicators of collaboration per se are needed to reach a holistic vision of how to improve the total quality of the project delivery. Our argument is that the project quality performance can be forecasted from the project management procedures. To prove this, we use user satisfaction as quality indicator, and we seek explanation for satisfaction level by qualitative analysis.

To complement reflective indicators like process variances or DQI, this research analyses collaboration from the perspective of formative indicators. The difference is that the formative indicators approach is a constructivist one, as the subject is determined by its indicators rather than vice versa (Diamantopoulos and Winklhofer, 2001). By this decision we recognise that the beneficial collaboration is the sum of many dimensions that must be understood together to get a holistic view of project management's effect on quality. By creating a practical set of indicators for design management, we give our contribution to lean design management research.

2. Formative indicators for collaboration in design

In general, the indicators may be divided into two categories: reflective indicators and formative indicators. Reflective indicators are based on the classical test theory. They assume that every measure reflects an underlying construct, i.e., the object under examination (Podsakoff *et al.*, 2006). The formative indicators, on the other hand, are understood as rather causing the examined object than being caused by it (Diamantopoulos and Winklhofer, 2001). Indicators like value-in-use and cost efficiency may be understood as a reflective indicator; they reflect the success of the

project in terms of a stakeholder. For studying the mechanism, how the collaboration works, formative indicators are more revealing. When using formative indicators, the upper level construct is conceptualised as having multiple dimensions, with each of them representing an important aspect of the construct (Bollen and Lennox, 1991), i.e., the examined phenomenon is analysed by pieces that cannot be completely separated from each other, and therefore they must be described as aspects of examined upper level construct. Socio-economic status is a classical example of such construct, as it is formed as a combination of education, income, occupation, and residence (Diamantopoulos and Winklhofer, 2001). Thus, as the collaboration is a multifaceted social construct which has multiple dimensions, we suggest that the formative perspective is suitable for this research.

3. Collaboration in design

There are many ways to describe collaboration: Kvan (2000) describes collaboration in design as working together in a higher sense to achieve a holistic creative result. Emmitt and Ruikar (2013, p. 10) describe the collaboration in temporary project organisations as an activity of multi-disciplinary groups and teams that are held together by legal contracts and the desire of participants to achieve a shared objective. Lundström *et al.* (2016) have determined the collaborative design as an upper level term that includes the sub-concepts of participatory design (PD), integrated design (ID) and concurrent engineering (CE). In PD, the users' role as influential member of a designing team is embraced. In ID, the integration between designing disciplines and utilisation of BIM as common designing tool are emphasised, and in CE, the collaboration between designers and contractors is embraced. Each sub-concept has a dedicated stakeholder group whose prime objective the collaboration serves: PD is dedicated to enhancing the ability to maximise value-in-use, ID is dedicated to enhancing designers' ability to coordinate

design work and to produce as accurate information as possible, and the role of CE is to find a cost-efficient design solution through collaboration between designers and builders (Lundström *et al*., 2016).

To understand what the formative indicators of beneficial collaboration in designing are, we study the common dimensions of the individual applications of collaborative design (PD, ID and CE) that could explain the effects on the project outcome. In the following discussion, we identify four such dimensions (listed below) that are tested in the empirical part of this research. The suggestion is that these are such dimensions that indicate whether the collaboration brings mutual benefits to stakeholders.

(1) Communication within each stakeholder group

(2) Communication between stakeholder groups

(3) Interactions concerning user value creation

(4) Interactions concerning alternative solutions analysis

No matter which determination of collaboration is used, there are major hindrances to it in construction projects. The customer often has a responsive role instead of an equal one, and hence only the construction professionals act as active participators (Cherns and Bryant, 1984). In addition, Butt *et al.* (2016) have identified major insufficiencies in project communication procedures regarding change management. According to their observations, ordinary communication routines do not guarantee sufficient utilisation of all stakeholders' know-how. Instead, a great deal of customisation and leadership is required. Yet, Kvalnes (2016) notes that the traditional project management model appears to be uncomfortable with the concept of

uncertainty. It treats all uncertainty as negative risk, instead of recognising the positive and energising aspects of uncertainty that may provide surprising opportunities and therefore be a source of creativity. Koskela and Howell (2002) have criticised the traditional project management model for a lack of sufficient perspectives, as the traditional model only recognises the project as a transformation from input to output. They argue that a sufficient project management model should also recognise the views of workflow and value. This transformation focus is observable in Gorse and Emmitt (2007) study where they found that most interactions in construction meetings are task-focused though some socio-emotional interactions also exist. However, the share of socio-emotional communication is so low that it may be interpreted as avoiding such behaviour in meetings. But it seems that the socio-emotional communication is needed to enhance workflow, as the stakeholders use informal channels to circumnavigate formal procedures for communicating more effectively (Emmitt and Ruikar, 2013).

den Otter and Emmitt (2008) have recognised two popular communication tools for design management: dialogue and design meeting. According to their research, the design managers prefer dialogues and use design meetings as a complementary communication tool. Personal dialogue between manager and technical expert is an appropriate way for developing a common understanding, giving instant feedback and resolving sensible issues. Mutually agreed outcomes may be presented in the formal design meetings after the personal dialogues, and they may be discussed with other stakeholders (den Otter and Emmitt, 2008).

However, this fragmented management style sets certain limits to creative problem solving, and therefore it is necessary to separate communication within and between stakeholder groups as different indicators. When the content of the design tasks is discussed in one-on-one dialogues and the role of design meetings is to spread

information and follow up on task accomplishment, the creative communication between the stakeholders is restricted. Even though dialogue between the designing disciplines may occur, it is not systematically encouraged. In comparison, the adoption of the 'big room' design environment may change the work culture into a more collaborative direction. The idea of the 'big room' is that all design disciplines and builders, including the subcontractors, are working in the same physical space. Deming's (1986) leadership philosophy has probably had a significant effect on the proliferation of 'big room' working. Breaking down the barriers between departments and driving out fear from expressing concerns or ideas are two of his famous 14 principles. An open-minded and free communication culture supposedly presents opportunities to get feedback in informal discussions, and to express and elaborate creative solutions to problems, and this atmosphere is opposite to two malicious habits: the habit of 'not listening,' i.e., a command-and-control style of management, and the habit of 'not speaking,' i.e., the fear of being talked down if one expresses original ideas (Forbes and Ahmed, 2011).

Ning (2017) suggests that the project management's ability to combine control and trust in an appropriate way determines the project's success. To succeed, project management must be convinced that the partner has professional competence, and only after that will control produce recognisable benefits. Control will focus on the partner's behaviour during the project or on the outcome of the project. Using appropriate control betters the project performance regarding the budget and schedule discipline. However, to improve the quality performance, control should be replaced with the goodwill-trust style of management by ensuring effective communication and increasing the range and depth of information transfer (Mao et al., 2008).

Chiocchio *et al.* (2011) have studied the effects of trust, conflict and

collaboration on performance. They divide the effects of trust into the ’positive trust-performance’ relation and ‘negative task conflict-performance’ relation. In the positive trust-performance relation, the trust among stakeholders affects performance through collaboration, which means that said trust enables a higher sense of working together and triggers the collaborative ways of working that leads to better task synchronisation, communication, feedback and anticipatory coordination in a more explicit manner (ibid.). As different stakeholder groups have different objectives (Lundström et al., 2016), it is supposedly harder to achieve trustful relationship between them, e.g. users and designers, than it is within one stakeholder group.

Daft and Lengel (1986) propose that organisations process information for two reasons: to reduce uncertainty and equivocality. The difference between these two terms is that uncertainty means sheer lack of information, whereas equivocality means the existence of multiple and conflicting interpretations of the issue. This dualism is essential in understanding the collaboration. For example, PD is supposed to not only help achieve consensus within the user stakeholder group (Savolainen et al., 2015) but also create better ideas about utilisation (Lundström et al., 2016). Reducing conflicting interpretations may be understood as matter of trust building, but information creation in designing process is a matter of value creation. In the following paragraph, we elaborate the latter two indicators, interactions concerning value co-creation and alternative solutions analysis, in relation to the information or value creating design process.

4. Re-phasing the project

To establish a connection between designing process and quality delivering process, we have re-phased the project to follow the discipline of quality engineering to substitute

the traditional division into five phases: initiating, planning, executing, monitoring and closing (Project Management Institute, 2013). As explained in the following discussion, the quality engineering approach divides a project into four phases: concept design, technical design, implementation, and testing and using (Figure 1).

[Figure 1 near here]

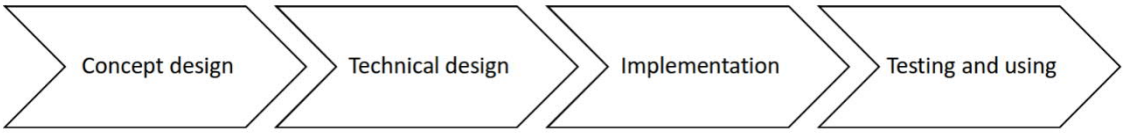

Figure 1. Project phasing inspired by quality engineering

4.1. Concept design

In the concept design phase, the first drawings are drafted to portray the intangible targets of the project as a physical outcome. Juran and Godfrey (1998) define quality with dual nature: on the one hand, quality is features of the product that meets the customer's needs, and on the other hand quality is freedom from deficiencies. To begin with this, the first phase of the project is to expose the customer's needs. In quality function deployment, the user value creation is understood as a task of making a quality plan (Akao, 1990), i.e., determining what to make and how it responds to customer-driven quality. The purpose of the PD is to act as a communication platform to enhance users' articulation and contextual understanding about what is appropriate for the work and for the organisation's activities (Lindahl, 2004), and thus bring up and elaborate ideas outside the set of traditional solutions. PD is closely related to the concept of co-creation, which means that the producer and customer are co-creating value-adding solutions by utilising the customer's know-how. To do that, there must be dialogue between these two, mutual access to sufficient data and mutually conducted risk assessment, and the relationship must be conducted in a transparent manner (Prahalad and Ramaswamy, 2004).

4.2. Technical design

We use the term ‘technical design’ for the phase of designing the efficient buildability of the concept. In quality function deployment, the corresponding phase would be detailed design and preproduction, which focuses on converting the final product quality into quality characters of the components, setting the tolerances and planning the quality assurance (Akao, 1990).

When entering the technical design phase, the focus shifts form the conceptualisation of customer needs toward the technical solutions. The means of collaboration shifts from PD toward ID as the role of technical discussions within the designers increases. Forgues and Koskela (2009) claim that the client’s lack of understanding of his role in the ID process is a main obstacle to the proliferation of ID. Regarding the former reasoning, this may be due to the absence of PD, because if the ID is present without PD, the collaborative ways of working are brought into the middle of the ongoing process. If there has not been sufficient dialogue to create value in the concept design phase, the customer may find it difficult to adopt anything other than a reactive role, leaving interest toward ID low. But even if this happens, the ID may still be used for alternative solutions analysis by detecting clashes between water pipes, ventilation ducts, electrical systems, etc. with BIM or breaking barriers between disciplines with an open-source data sharing policy (Sebastian, 2010). But in that case, using the terminology TFV theory (Koskela, 2000), the transformation and flow perspectives are well-represented while the value perspective is absent.

4.3. Implementation

When the designs are sufficiently ready, the implementation may begin. It should be noted that only on rare occasions are the designs fully completed in construction projects before the implementation begins. Therefore, the technical design and implementation is often overlapped. In quality engineering, the implementation is

divided into two tasks: production planning and production (Taguchi, 1986; Akao, 1990; Juran and Godfrey, 1998). In construction projects, these two tasks are constantly present as foremen plan upcoming work phases while supervising ongoing work.

Koskela and Howell (2002) point out that in the implementation phase of the project, there may occur situations where all inputs or resources, material or information, are not ready at the planned starting moment of some task. The CE is supposed to prevent these kinds of situations. The value perspective is an essential part of CE, as it seeks to cut costs by eliminating non-value-adding activities (Love and Gunasikaran, 1997), reducing production times and improving quality (Anumba and Kamara, 2012). The value perspective is present both in the task of improving quality and in recognising non-value-adding activities i.e. waste. The elimination of them, on the other hand, is an alternative solutions analysis task as well as a reduction of production time.

4.4. Testing and using

The 'testing and using' phase refers to the time after the product is handed over from producer to user. However, the quality engineering literature is quite product-centric as it separates production and customer service from each other (e.g., Juran and Godfrey, 1998). By contrast, Vargo and Lusch (2004) think that a product is only a way of delivering specialised skills, and they consider that full delivery contains all that the customer needs to receive the benefits from such skills. Therefore, they do not want to separate the product from the service necessary to utilise it. Thus, we consider that the time after handover is as essential as all other phases regarding the quality of design, even though there is no recognised application of collaborative design that could be implemented after the project is handed over (Lundström *et al.*, 2016).

Juran and Godfrey (1998) have identified four important aspects of customer

service: strategic intent, design, organisational structure and operational management. Collaboration during the project may help establish good service, and post-occupation evaluation of designing is a good way to support decision-making (Piroozfar, *et al.*, 2013). However, mere evaluation leads to little improvement if something needs to be fixed; investments may be required. Each party of the contract (e.g., lease agreement) has its own subjective understanding about what they are entitled to, and that may lead to a situation where the interests are conflicted and at least one of the parties feels mistreated and retaliates (Hart and Moore, 2008). Therefore, continuous improvement in user value creation and alternative solutions analysis are essential parts of a working customer relationship also after the project is handed over. And because the investment decision may be different depending on whether the client and supplier are two non-integrated entities, the client owns the supplier or the supplier owns the client (Grossman and Hart, 1986; Hart and Moore, 1990; Hart, 1995), the service issues and possible improvements should be regarded in the ownership arrangements of the premises and the equipment related to it, but also in the design assignment to ensure the fluent adaptation of the premises in case of changing user requirements. This is necessary to ensure the continuation of value co-creation beyond the handover date.

5. Case

The case project is a renovation project where a 300 m^2 learning environment a rehearsal newsroom, was renovated to match the needs of the new media environment. Since the previous renovation of the premises in 2005, the focus in the journalistic media has moved from print and desktop-oriented production and consumption to ’mobile-first‘ and a more audio-visual approach. This change has had a tremendous impact on production workflows and the tools used, and to the orientation and co-operation in the newsrooms.

The new learning environment was supposed to serve as a platform for teaching the ’mobile-first‘ style of publishing. In the 2010s, new mobile devices, tablet computers and smartphones, revolutionised the publishing philosophy. The old way was to edit a newspaper on a desktop computer and slice some content of it to the web. The new mobile-first way enabled a non-desktop workflow, where news are produced and downloaded in any location with mobile devices to a content management system. Then the editors in the newsroom consider how the content is delivered via web pages and social media, and the printed version is considered after these two phases.

The change was tremendous for both the tools and the devices. The old premises were full of desktop computers for newspaper editing. The ’mobile-first‘ approach required different places for meetings and audio-visual (AV) and multimedia production and content viewing. Naturally, lots of tablets and laptop computers were also needed, as were suitable environments for learning how to use them. All this required high-tech wireless transfer systems for both internet connections and AV contents, and that made the project technologically challenging to design. In addition, there were ventilation and piping changes, and the building automation was also modified. Therefore, a full designing team was commissioned for a small-scale project, and that made the case suitable as a critical case for researching the collaborative ways of working.

6. Research method

Mixed-method approach which entails both quantitative and qualitative data collection techniques and analysis procedures was adopted as main research approach of this study (Saunders *et al.* 2009, p. 152). This approach is considered suitable for triangulation in construction project management studies (e.g. Allen and Smallwood, 2008; Lindebaum and Fielden, 2010; Lindebaum and Cartwright 2010). The data used in this research was collected from a user satisfaction survey and from documentation of the case project

within an archival research strategy.

The quantitative survey was conducted among the users of the premises that were renovated in the case project. The approximated size of the target population was 200. A total of 49 users answered the survey, and 43 of those answered all questions. The survey was conducted as web questionnaire, and the link to the questionnaire was shared by e-mail using several overlapping mail lists to reach as many potential users as possible. Hence the exact number of the population is unknown. The analysis was conducted by using a Net Promoter Score® (NPS) distribution analysis method (Reichheld, 2006), which is developed to recognise ultimately positive satisfaction level from ordinary positive satisfaction level.

The qualitative component of the study was an archival analysis over project meeting memos, project schedule, project budget and cost calculations, workshop material such as drafted drawings, and video-recorded presentations of users. The analysis had deductive approach as there were predetermined indicators which were supposed to explain the causality between the managerial acts during the project and the performance in satisfactory survey. Explanation building is a deductively based analytical procedure, which involves an attempt to build explanation in an iterative manner by collecting data and analysing it simultaneously (Saunders et al. 2009, p 500). The lead researcher had a role as an inside observer, as he was the project manager of the case project. Thus the researcher was able to observe the impact of managerial acts, and also obtained information regarding informal communication.

7. Results

To create a useful formative indicator there must exist a set of sub-indicators that cover the examined subject. The coverage of the sub-indicators can be tested by using

reflective indicators. In addition, the sub-indicators must have suitable metrics that makes them usable in practice.

In the following analysis there is a qualitative component, which examines the sub-indicators deducted from the literature that are supposed to cover the phenomenon of beneficial collaboration. The other component is the analysis over the quantitative survey, which is used to test the coverage of the sub-indicators. The analysis is a result of an iterative process which has led to development of indicatory metrics for each sub-indicator.

The quantitative analysis is presented first, and the qualitative analysis follows. This presentation order is chosen to first provide a glance at the numeric satisfaction performance, and then to present the descriptive analysis concerning the management procedures which have led into such performance.

7.1. Results of the satisfaction survey

The satisfaction survey was analysed by using NPS distribution analysis method (Reichheld, 2006). In this method the answers are clustered into three categories: the ‘detractors’ who are unhappy and spread negative comments about the product or the service, the ‘passives’ who are quite satisfied but do not actively recommend or warn about the product or the service, and the ‘promoters’ who actively spread positive comments and recommendations. The score is calculated by subtracting the number of detractors from the number of promoters and then dividing the result by the number of all answers. The resulting score is presented as a percentage.

The questionnaire was drafted by the project manager in collaboration with the teachers. The questionnaire was based on Lundström et al. (2016) categorisation (emotional-practical-infrastructural) to verify the satisfaction regarding the predetermined project

objectives. A key question of NPS was presented at the end of the questionnaire: ‘How likely is it that you would recommend this learning environment to your friend or colleague?’ The NPS was 37 % (promoters f=23, detractors f=7, n=43), which may be considered to indicate a successful project.

Similar distribution analysis was conducted to all questions to recognise factors that could explain the project’s success. A scale of 1 to 5 was used, where answers 1 and 2 are determined as detractors, answers 3 and 4 are determined as passives, and answer 5 is determined as promoters. The result was that fulfilling the needs in the emotional category was suggested to best explain the high performance in NPS.

In the emotional category the score ranged from 40 % to 43 % in the question related to cosiness and comfort. In the questions related to work culture the score ranged from -6 % to 21 %. Therefore, it was suggested that high performance in NPS can be achieved by fulfilling a certain set of emotional need, and it does not require high performance in fulfilling every emotional need.

In the practical category, the questions concerning cosy furniture, phone booths, and kitchen got the highest scores ranging from 59% to 70%. The questions regarding work conditions like group work places and desks also received quite high scores ranging from 32% to 37%, but questions related to information technology got low scores ranging from -18% to 0%. The lowest score (-57%) was given to guidance of new systems like wireless printing and video streaming. The interpretation was that the NPS performance may be high even though a lot of useful features are missing, if the cosy atmosphere is achieved.

The infrastructural category received only low and modest scores. These were questions regarding right temperature (9%), air freshness (-5%), noise insulation between spaces

(-14%), lighting (23%), and tidiness (-37%). The interpretation of these results was that high performance in NPS does not require high performance in serving infrastructural needs.

7.2. Communication within each stakeholder group

In the analysis, one of the observations was that the people in management tend to write task lists and follow-ups to reduce equivocality. This behaviour does not depend on the writer. In our case, there were at least three different memo writers – the project manager, the project assistant and the general foreman of the contractor – and all of them listed things that some stakeholder group had done or still had to do.

For example, in the concept design phase there was discussion about how each space of their new premises will work, and what they must find out and decide about the new devices and other equipment. In the technical design phase, there was a list of things and principles that designers must consider. Each of them included some instruction on what to do, like 'Mechanical engineer will check how many people could be served without major changes to the ventilation system' or 'Door is missing from the architectural designs,' which means the task of adding the missing door. The same kind of notes was observed also from the memos of the implementation phase; the difference was that usually the reason was additional information gained during the construction work.

Analysing documents with this point of view did not offer much new information about design management's effect on the outcome of the project. Based on the data, it seems this is something the importance of which is well-recognised among the professionals. There exist well-known procedures for metering the performance of task completion, for example, accomplishment rate of each subcontract is quite widely used in following

up construction work progress. In design management, checking which designs are ready may be considered a roughly corresponding procedure.

7.3. Communication between the stakeholder groups

The result of the analysis was that the management's relation toward uncertainties and equivocality is suggested to explain how communication between stakeholder groups may enhance workflow. On the one hand, it may be enhanced by systematically reducing uncertainties, but on the other hand, recognising the positive effects of some uncertainty and equivocality may also benefit the workflow. In the analysis, five different mechanisms of utilising beneficial uncertainty were recognised.

1. *Increased creativity.* Creativity requires enthusiasm and freedom of speech which means lots of different streams of discussions and increasing equivocality in communication. In this project there were two workshop sessions where such brainstorming was cultivated. The workshops processed plenty of ideas and produced material which was highly equivocal and far from ready-made concept plan. However, the workshop was a creative way of working, and the open atmosphere enabled users to express bold ideas and confess if they were unsure about something. Hence the brainstorming also increased honesty, and designers understood how users want to experience the work environment.
2. *Adopting more perspectives.* Listening to more people means more conflicting interests spoken aloud but not listening to them would not mean they do not exist. In this case the owner decided to use co-creational approach to ensure that the concept design would be done by using the best and the widest available information. The workshops provided equal possibility to participate for all user groups and designers, and hearing ideas and opinions in dialogue between students, teachers, maintenance and various other people helped designers to

gain a holistic view of the requirements. This helped in avoiding unpleasant surprises in later phases.

3. *Increased maturity of information.* The prerequisites of design tasks largely consist of different kind of information. Some of that information is in explicit form, e.g. designs made by other designers, but in some, information exists in more indefinite form. For example, users produce information regarding their functions and desires for the designers, but when they describe their activities in the premises being built, they are discussing an uncertain future. Beside the sheer lack of knowledge there is equivocality about the objectives, and there could be a lack of consensus too. These issues need dialogue and time to mature before they can be solved. The design manager must understand the learning curve of the users, as the actualisation of the new premises enhances the users' ability to understand the link between their work and work environment. Learning cannot be forced, and thus mere systematic reduction of uncertainties with deadlines is not enough.
4. *Task prioritisation.* The key element of design synchronisation is design schedule, which recognises not only deadlines but also the moments when the prerequisites for each task are available. After the workshops there were three recognised areas which each had a different role in the concept design. There was a lecturing and informal learning area, a kitchen and equipment loaning area, and a radio edit area. The design tasks were prioritised by the maturity of the prerequisite information. In this case the lecturing and informal learning area was designed first because users had the most precise understanding about the requirements of that area. The radio edit area had the least precise role in the concept, and therefore the least design resources were invested in it. This

decision proved to be right, as after the concept design phase the area was left outside the project's scope to save costs.

5. *New solutions suggestions.* Being a finder of good solutions is a prominent part of a talented designer's identity, and if they are talked down because of suggesting good solutions, they will be frustrated. In some occasions the most appropriate solution may be recognised at such a late stage that the suggestion increases uncertainty in matters that have already been considered as solved. However, sometimes upcoming information may change the understanding about the most suitable solution but accepting the new, better solution at such a late stage that may be an issue. If the project management transparently communicates the uncertainties that may still affect the outcome, it may ease the acceptance of the new solution among the other stakeholders. In this case, the users stated in the middle of the technical designing that they need to be prepared to 4K display technology and four different streaming technologies. That meant major revisions to the all designs because to afford the additions something had to be cut off. If the success of the design would have been measured by a list of ready-made plans, the request of adjusting almost every drawing would have felt discouraging. Instead, as it was communicated that the designs are ready when the project is handed over, mental power was not used to protest the inevitable change.

Based on the observations, three levels of utilising uncertainty were recognised. First is the systematic reduction of uncertainty. On that level the only positive side of uncertainty is that it is recognised and may be removed. The second level is acceptance of uncertainty that is unremovable for the present. That helps to prioritise tasks that have the best chance to be accomplished effectively, and guides to plan the schedule by

respecting each stakeholder's learning process and changing conditions. The third level is cultivation of creative uncertainty and equivocality. On that level the management attempts to achieve information in more effective manner by temporarily allowing more uncertainty and equivocality in conversations.

7.4. Interactions concerning user value creation

In the concept design phase, two co-creational workshop sessions were organised to produce wide-ranging material on value-in-use. To reach a holistic impact, the concept design of the case project was designed by using emotional-practical-infrastructural categorisation of user needs (Lundström *et al.,* 2016). In the case project, this method helped to understand not only how the learning functions may be supported but also how to support the students' evolving professional identity. One of the initial reasons to start the project was to enable teaching 'mobile-first' style of publishing. The initial instructions for the project were very technology-centric but the workshops provided abundant information on the requirements for the learning environment in general.

First, the categorisation was used to understand the roles of different places and spatial resources. As journalism education is implemented in a context-dependent manner, it was understood that it is important that studying in the rehearsal newsroom must feel like working in an actual newsroom. Therefore two spatial resources, news desk and kitchen, were considered most important. The news desk is a place which will gather all the news sent from various locations and process them to web, social media and print delivery. The kitchen is linked to the journalists' duty to work around the clock resulting in a need to have coffee available at all times. These two places had a clear link to emotional needs, whereas other learning spaces were recognised to serve more practical needs. The users stated some requests linked to infrastructural needs, mainly complaints about cold indoor temperature during the winter, but it was decided that

improving these matters will be left outside the project's scope. It was suggested that serving practical and emotional needs would create more value in this case.

In the later phases the categorisation was used in furniture designing and technical designing. In furniture design it was realised that the office furniture should be practical, but the furniture should also support a comfortable and confident atmosphere. One reason is that journalist students do lots of interviews, and the other reason is that getting personal feedback from teachers is an essential part of the studies.

Some technical features such as acoustics and transparent walls were recognised to have connection to emotional needs. These aspects were mainly discussed in design meetings, attended by project management, designers, and a couple of user representatives. The user representatives and designers had also one-to-one discussions.

The survey analysis confirmed the performance of the value strategy selected in the beginning of the project: high satisfaction level was achieved by systematically aspiring to fulfil the recognised emotional needs. In addition, it was reached regardless of the poor scores in IT and AV issues. Those aspects have a significant role in practical sense, but they do not have such a strong link to the emotional needs. Therefore we suggest that the emotional-practical-infrastructural categorisation of user needs may be used as metrics for value creation.

7.5. Interactions concerning alternative solutions analysis

When analysing the decision-making and its preparations, it was observed that there were two different decision categories: go or no-go decisions and equal options decisions. In a go or no-go decision, the preparations were made for the chain of command, and the purpose of the preparations was to make an easy decision to continue the project as planned. In equal options decisions there were no obvious ways how to

carry on, and the purpose of the preparations was to analyse the effects of each option. Combination of these was found to be both analytical and effective way of making decisions, as lack of the first would have led to hesitative inefficiency and lack of the latter one would have resulted in command-and-control style of management, where the existence of only one solution is allowed. In the analysis four criteria were found to distinguish whether both elements are present.

First criterion is information basis. In the go or no-go decision, the preparation perspective is need-to-know basis. Information is delivered to a decision-maker to get a fast decision and therefore there cannot be too much of information or too complicated information, and hence the sufficiency of the information is rarely questioned. In equal options decisions the preparations are made on a need-to-evaluate basis. The purpose is to come to a well-considered decision, and therefore the information must contain multiple perspectives and even conflicting interests are allowed. For example, in the concept design phase of the case project the architect had adequate information about user activities after the first workshop to create a concept design. The decision on proceeding the project could have been made between a couple of the most influential people in the project. But instead, the second workshop was organised to evaluate the design by using as much information about user perspectives as possible.

The second criterion is transparency. In the go or no-go decision, the preparation perspective is to make sure that those who have power understand all necessary information at a glance. In equal options decisions the preparations include a chance to comment and contribute. The information is transparent to uncertain issues and thus it may contain open-ended questions that encourage to evaluate options by qualitative means. Therefore the way of presenting information and facilitating dialogue is in a key role. For example, in the second workshop of the concept designing there was a layout

suggestion but the participants were committed to redesigning it for better results. If the users had been asked to comment on a ready looking layout drawing by e-mail the result would had been quite different.

The third criterion is power sharing. In the go or no-go decision, the preparation perspective is to recognise the chain of command to understand how the decision can be fluently made. In equal options decisions the focus is on recognising the value creation network to better understand who knows he effects of the decision on value in use. This usually means the grass root level where there is less influence in important decisions. For example, in this case, the value creation network exists in the learning process of students, and participatory design among them and teachers enables value-based evaluation of options. However, from this point of view it is utterly important to have a combination of both styles, because the users usually best understand the effects on value-in-use, but the management understands the effect on cost and resource consumption. In the case project, the power sharing enabled users to have an active role throughout the project, and the possibility to add value by extending the project's scope resulted in extending the project budget by 50 % before final decision of implementation. It would have been a crisis if both the value and cost had not been transparently communicated all along the project. And on the other hand, denying power from users would have probably resulted in an even greater loss of value.

The fourth criterion is the ability to iterate. In the go or no-go decision, the preparations focus on keeping up the schedule. The effort is put on recognising the critical path and the pressure to make the decisions comes from the risk of delay. In equal options decisions the focus is on learning curve and recognition of unfinished work. For example, in this project in electrical designing it was recognised that the IT equipment and AV systems design process would greatly benefit from iterative

designing method. The ordinary design-bid-build contract would have resulted in stiff contractual relationship, and therefore it was decided to use cost-plus contracting with a price ceiling. The place, type and number of sockets would not have been a big issue cost-wise, but the project manager considered that using ordinary stiff procedures would have given a wrong signal about the design management style. Instead, the project manager chose to encourage flexible style and iterative mentality to enhance quality.

7.6. Indicators in practice

The results of the analysis are summarised in figure 2. It presents the beneficial collaboration as a multi-faceted social construct, status of which is observed via four sub-indicators. The status of the beneficial collaboration is understood as indicator which can be used to forecast the quality of the project's outcome.

[Figure 2 near here]

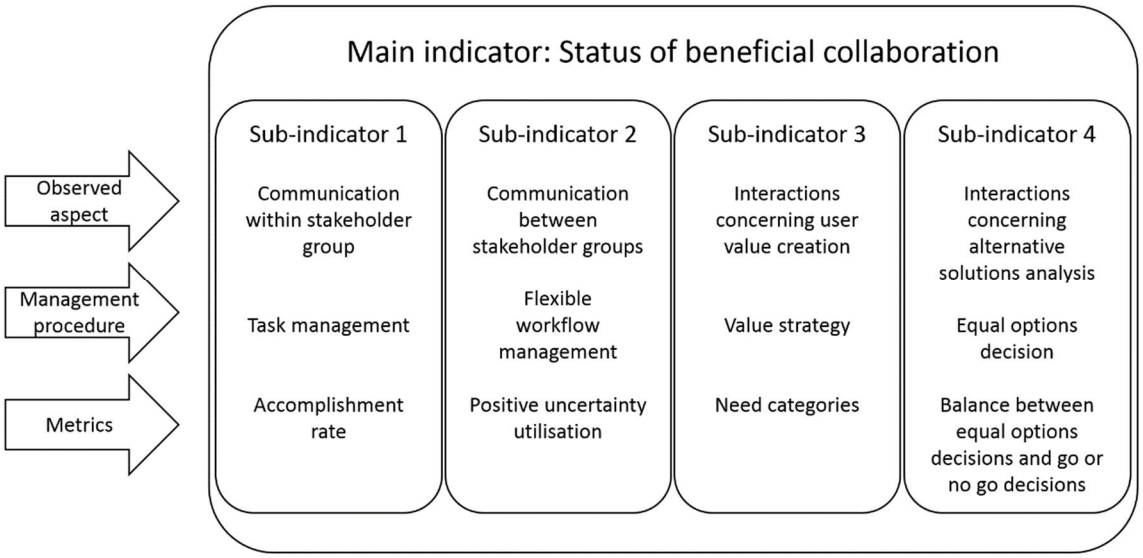

Figure 2. The break-down regarding the indicator of beneficial collaboration

The coverage of the sub-indicators is rationalised by first identifying the information basis i.e. are all necessary stakeholders heard or is some important source of information yet to be heard. Second aspect is to identify how the benefits are verified,

and third aspect is to analyse how these indicators identify collaboration. In addition, this examination pursues to illustrate the practical use of the indicator system.

The information about beneficial collaboration is considered to exist in the communication and interactions between the individuals participating to the project. In the indicator system, the individuals are categorised by their roles, which in this case are the users, the designers, the implementers, and the owners. It is supposed that these stakeholders have key roles in value creation i.e. meeting user needs: users possess the information on their needs, designers determine suitable solutions, implementers find a feasible to deliver solution, and owner finances it and considers the suitability and modifiability for another uses in case there will be new users.

Of course, in some other projects there may exist some other roles, for example building control authorities may play a significant role in some projects, or some NGOs may want to influence the outcome of the project's societal impact. However, if these are not direct users, or if they do not possess such information on solutions that the designers or implementers need to do their jobs, they do not have a role in value creation.

The indicator system considers value creation as a process where the understanding of how different solutions may benefit users is learnt along with the designing task and implementation. The learning process may be facilitated but not forced, and therefore the collaborative management is considered to have a positive impact on value creation. The first sub-indicator observes whether tasks of such a stakeholder are managed who has a key role in value creation. The second sub-indicator observes whether the management enables the learning process. Accepting the positive uncertainties is essential, because that states the fact that there are things to be learnt

about the connection between the needs and solutions. The third sub-indicator recognises whether the design focuses a holistic impact or if there is risk of sub-optimisation. If there exists a value strategy that pursues holistic impact over emotional, practical and infrastructural needs, the implementation of that strategy, i.e. how it affects the designing decisions, should be visible in the project management procedures and the documentation. If there is no such strategy applied, then it is very likely that, for example, if pressure for cost cuts occurs, the cuts are made without considering the impact on the users' needs in the all categories and the relative importance of the needs.

The demand for cost cuts is an example of a typical decision-making situation where preparation is of great importance. The preparation is in many cases balancing between the effort of finding a good compromise and the risk of a hasty decision in a situation where the project management has their hands full of work. The fourth indicator identifies whether the decision is prepared in a collaborative manner, or has the management taken a shortcut to save effort. In the case of cost cuts, it would be preferable if the decision was prepared with sufficient understanding about value and in dialogue with those who must live with the decision.

To be critical about the usability of the indicator system, it must be stated that it does not provide a numerical forecast about the satisfaction level as such. However, it contains a usable checklist which may be used to determine the state of beneficial collaboration in any given point of a project. If such audition reveals major insufficiencies in the management procedures, it enables to demand explicit improvement to those procedures, and what is more important, to act in a proactive manner to prevent conflicts.

8. Discussion

In this article we have examined how quality of the project's outcome can be forecasted from the management style and managerial acts. Our findings suggest that the forecasting is possible, and the underlying mechanism is quite similar to the one theorised in TFV theory (Koskela 2000). Our findings support Koskela's (ibid.) observation that the transformation perspective is not adequate to describe optimisation of project management. However, the lean construction ideology has been traditionally focused on the production phase of the project (Koskela 2000; Koskela and Howell 2002; Salem *et al.*, 2006), although there has been interest toward lean design management (Forbes and Ahmed, 2011; Emmitt, 2011). Our contribution is to provide insight into the managerial practices of lean design management.

The quantitative component of this research verified that a high level of quality was reached in terms of customer satisfaction. The qualitative component of the research has explained how trust and flexible workflow management, value strategy, and decision preparation style affect the project's quality performance.

Flexible management of uncertain prerequisites of design tasks means that design team members must be able to trust each other's competence to solve unknown uncertainties in time. Thus, the findings are in line with the trust-related research such as the concept of 'positive trust-performance' (Chiocchio et al., 2011), how range and depth of delivered information affect trust and quality (Mao et al. 2008), and a finding that the competence trust is a key element of project performance (Ning, 2017). We contribute to this body of knowledge by presenting five underlying mechanisms (increased creativity, adopting more perspectives, increased maturity of information, task prioritisation, new solutions suggestion) which explain how flexibility and mutual

trust among the stakeholders enhance the workflow of designers.

The examination of the value creation explained how a value strategy can be created by using infrastructural-practical-emotional user need categories (Lundström et al., 2016). Our contribution is to verify that forming a strategy in the concept design phase, and following up systematically in managerial acts, is an important part in reaching good performance in customer satisfaction.

This research extends the TFV theory (Koskela, 2000) from theory of production to cover design management, by viewing decision-making in design management through transformation, flow and value aspects. In addition, the alternative solution analysis provides complementary aspect, which recognises whether the project is managed in a command-and-control style where only one option at a time is allowed, or whether the management utilises the evaluation of equal options. By adding that, the theory better covers the human resources management and explains the role of 'big room' designing. Yet the metrics suggested for each sub-indicator of beneficial collaboration enables managerial implications in supervision of project management.

9. Conclusions

In current managerial practices, the follow-ups of committed cost and accomplishment rates of scheduled tasks form the basis of forecasting in construction project management. These points of view give information for routine check-ups, whether there are problems or not and whether the potential problems are related to budgeting od scheduling, but they do not provide much information on the quality. The quality management practices rely on either inspections or post occupancy evaluations. The problems of these current quality management practices are that they provide too little information too late. Too little because the quality control inspections compare the

result to designs and technical specifications not necessarily directly connected to the customer needs that the product or service is supposed to fulfil, and too late because especially post-occupancy evaluations but also the quality control inspections examine work that have been already done. This means that the quality can be improved via rework, while the simultaneous improvement of quality and productivity would require proactive correction of erroneous conducts.

To illustrate the contribution of the presented indicator system to the quality management practices, a little mind game could be played: imagine that in the project report there would be sections concerning learning process regarding customer needs, impact on need categories, and balanced decision preparation assurance. How would it shape the designing practices, if the design manager had to report where the information on user needs comes from, and how the management assures that the design team has sufficient information, and how they are going to deal with the upcoming information that users will inevitably produce? Or if the project management was requested to explain the analysis and dialogue behind the suggested option in a decision-making situation.

In our experience, clients in construction projects tend to bring such topics into conversation, but only in rare occasions is there clear structured literal reporting concerning these matters. Our suggestion is that the absence of these matters in literal reports leads to biased focus in project management. The utilisation of the presented indicator system would bring balance by shifting the focus toward the quality issues and the value of the project from the consumed money and time. This would be beneficial especially in projects initiated for their societal value that are therefore difficult to value in money terms. The structure provided by the indicator system would also guide toward collaborative ways of working, which may be considered valuable as such.

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V

PROJECT IS AS PROJECT DOES: EMERGING MICRO-ACTIVITIES AND PLAY ONTOLOGY

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